Saddle Mountain Unified School District No. 90

Ruth Fisher School

208 WATER QUALITY MANAGEMENT PLAN

SMALL PLANT REVIEW AND APPROVAL

October 2004

Prepared for:

Maricopa County Environmental Services Department
Water & Waste Management Division
1001 N. Central Avenue, Suite 150
Phoenix, Arizona 85004

On Behalf of:

Ruth Fisher School
Saddle Mountain Unified School District No. 90
38201 W. Indian School Road
Tonopah, AZ 85354

Prepared by:

Fluid Solutions
Water • Wastewater • Engineering • Environmental Services
1121 East Missouri Avenue, Suite 100, Phoenix, Arizona 85014

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March 2004
Revised June 2004
Revised August 2004
Revised October 2004

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Registered Professional Engineer (Civil)
CERTIFICATE NO. 31118
KATHRYN H. MILLS
Date Signed 10-1-04
ARIZONA, U.S.A.

Kathryn H. Mills

ENVIRONMENTAL SERVICES
DEPARTMENT

Albert F. Brown, RS, MPA, Director

1001 N. Central Avenue, Suite 150
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MARICOPA COUNTY ARIZONA

WATER AND WASTE MANAGEMENT
DIVISION

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Maricopa Association of Governments
Received
OCT 15 2004

October 11, 2004

Maricopa Association of Governments
302 North 1st Avenue, Suite 300
Phoenix, Arizona 85003

Attention: Ms. Lindy Bauer, Environmental Program Coordinator
Re: Ruth Fisher School, 208 Small Plant Submittal

Dear Ms. Bauer:

Fluid Solutions has provided a revised 208 Small Plant submittal, dated October, 2004, to the Maricopa County Environmental Services Department (MCESD) for expansion of the wastewater treatment facilities for Ruth Fisher School, an elementary and high school complex to be development by the Saddle Mountain Unified School District No. 90. The facilities will be constructed in an unincorporated area located north of Interstate 10, between 383rd Avenue and Wintersburg Road.

In accordance with the MAG 208 Water Quality Management Plan, Section 4.6.2 (Small Plant Process), the proposed 208 Small Plant submittal for the facility was provided to this Department for review and sponsorship, since the facility is located within an unincorporated area of Maricopa County, outside of any municipal planning areas. Since the facility is located further than three miles from any municipality, comments from other communities were not required.

Based on a review of the revised proposed 208 Small Plant Submittal, dated October, 2004, the MCESD has determined that the proposed plant is acceptable and complies with the Small Plant Review and Approval Process under the MAG 208 Areawide Water Quality Management Plan. MCESD acknowledges that the proposed plant expansion for the Ruth Fisher School is also not in conflict with Maricopa County plans for the area.

Please note that although the design concept report is included as an attachment to the Small Plant Submittal, MCESD has not reviewed, nor approved, the design concept report as part of the 208 Small Plant Review. Any technical issues that remain will need to be resolved during the design phase of the project. Approval to Construct and Approval of Construction must be obtained from this Department prior to start of construction and startup, respectively.

If you have any questions or comments, please feel free to contact Mr. Dale Bodiya, PE, or myself, at 506-6666.

Sincerely,

, PE

John A. Power, PE
Manager, Water and Waste Management Division

cc:
Mr. Albert F. Brown, RS, MPA, Director, MC Environmental Services Department
Mr. Dale Bodiya, PE, Manager, Water / Wastewater Treatment Section, MCESD
Ms. Kathryn Mills, PE, Fluid Solutions
File

Ruth Fisher School
Wastewater Treatment Plant
208 Water Quality Management Plan
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Introduction

The existing Ruth Fisher elementary school will be expanded and a new high school will be constructed. These facilities will increase the volume of wastewater generated. This Small Plant Review and Approval proposes expansion of the Ruth Fisher School Wastewater Treatment Plant from 15,000 gallons per day (gpd) up to 42,000 gpd average flow in a new wastewater reclamation plant. The school is located in the 208 Plan outlying region of Maricopa County as shown in Figures 1 and 2. This Small Plant Review and Approval for a non-municipal planning area proposes to increase the capacity of this facility by replacing the existing 15,000 gpd plant with a larger one that provides nitrification-denitrification resulting in a Class A+ effluent. The resulting water quality will allow recharge for effluent disposal in addition to using it for irrigation at the school. The following sections summarize the 208 Small Plant process to formally consider the increase in treatment capacity, the planned student population and flow projections, compatibility with the existing 208 Plan, benefits and potential problems, as well as the funding and operation of the new treatment plant.

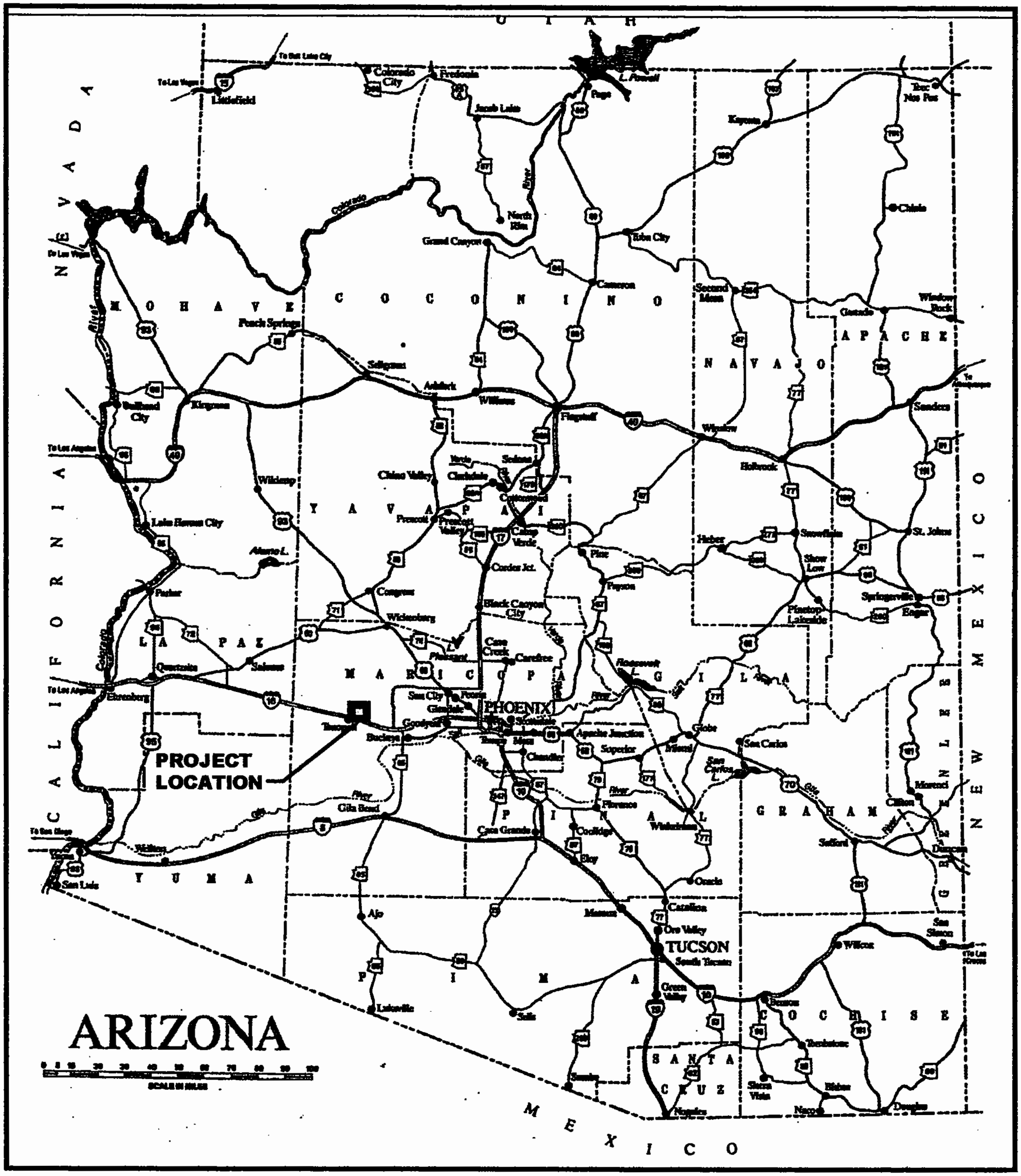
208 Small Plant Review

The Maricopa Association of Governments (MAG) is the designated planning agency with the authority required by Section 208(a)(2)(B) of the Clean Water Act to implement the 208 plan for the Maricopa County area. Maricopa County must initiate this Small Plant Review and Approval to MAG, because the county is designated as the local government and MAG member agency for the lands outside of a municipal planning area, including where this modification is proposed. The request for Approval is submitted on behalf of Saddle Mountain Unified School District No. 90, the owner of the Ruth Fisher School facility. This proposal is for expansion of a wastewater facility that has a flow less than 2.0 million gallons per day (mgd) and will not discharge to a surface water of the United States; therefore, the proposed facility will be reviewed through the small plant review and approval process. The process requirements are outlined in Section 4.5.2 of the MAG 208 Water Quality Management Plan, dated October 2002, and included in Appendix A.

Technical Criteria

Why Small Plant Is Required

The existing wastewater treatment plant is proposed for expansion because the student population is increasing and the school facilities must be expanded to provide more classrooms for the elementary school and the addition of a high school. The aging plant will be replaced to improve the effluent quality to allow recharge in addition to irrigation of the ball fields and landscaping at the school.



RUTH FISHER SCHOOL
208 SMALL PLANT REVIEW AND APPROVAL

FIGURE 1 - REGIONAL MAP

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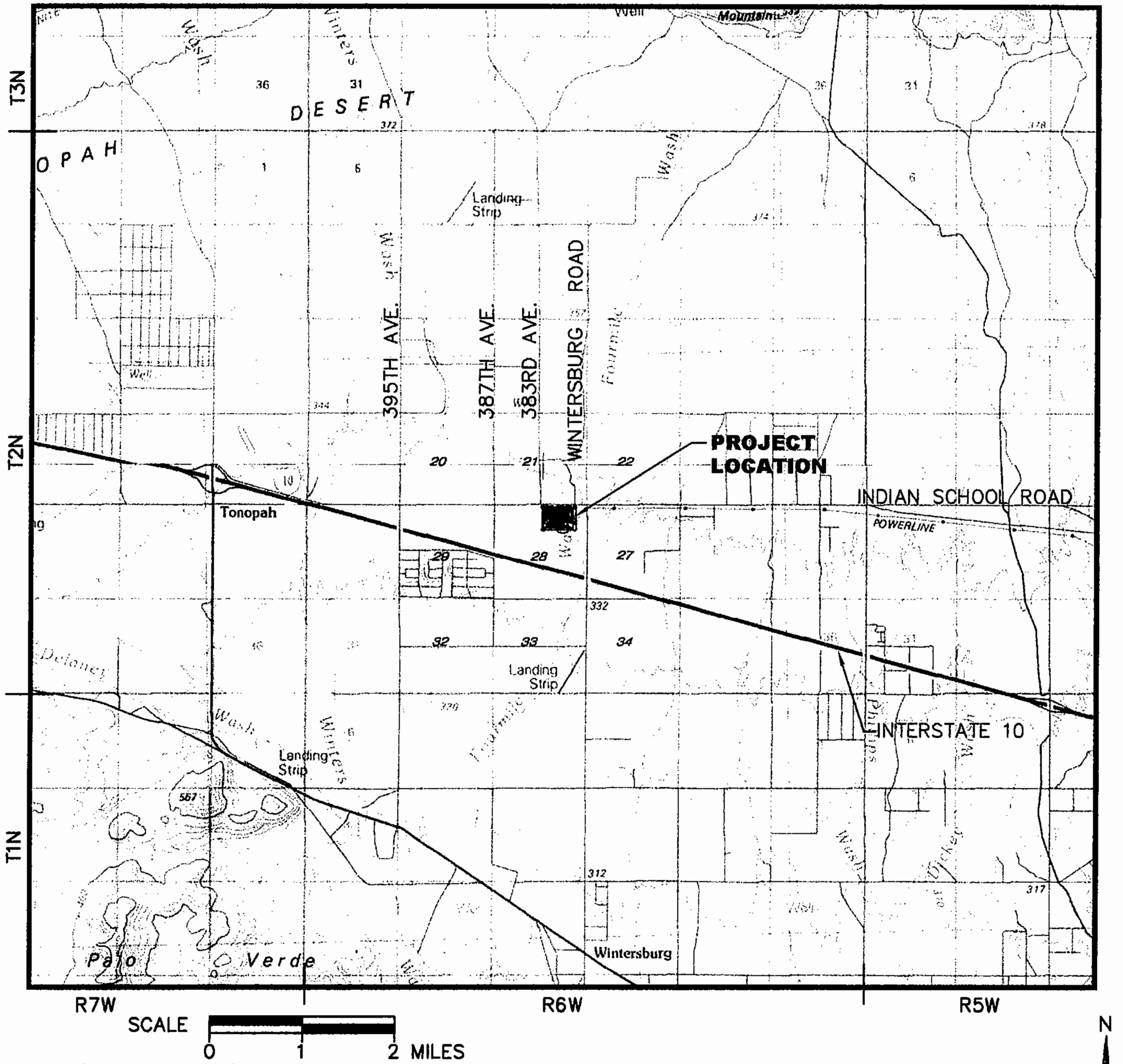

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208 SMALL PLANT REVIEW AND APPROVAL

FIGURE 2 - VICINITY MAP

The area that will be served by this facility is the school site at the southwest corner of Indian School Road and Wintersburg Road, north of Interstate 10 in Tonopah as shown in Figures 2 and 3. The existing gravity sewer system will be extended to serve the new facilities. The replacement WWTP site and existing plant are located in the northwest quarter of the northeast quarter of Section 28 as shown on Figure 3. The land is owned by the school district. The purpose of the facility is to permit wastewater from the school to be collected and treated. The effluent generated will be used to irrigate turf and landscaping within the school grounds and to recharge groundwater through subsurface infiltration chambers.

The plant is located in an unincorporated portion of the County more than eight miles west of the nearest annexation by the Town of Buckeye and farther from existing and planned development and treatment plants for Belmont and Douglas Ranch. There are no other planning areas within 3 miles of the treatment plant as shown in Figure 2. A few scattered houses in the vicinity are located between farm fields and have on-site septic systems.

Anticipated Wastewater Quality

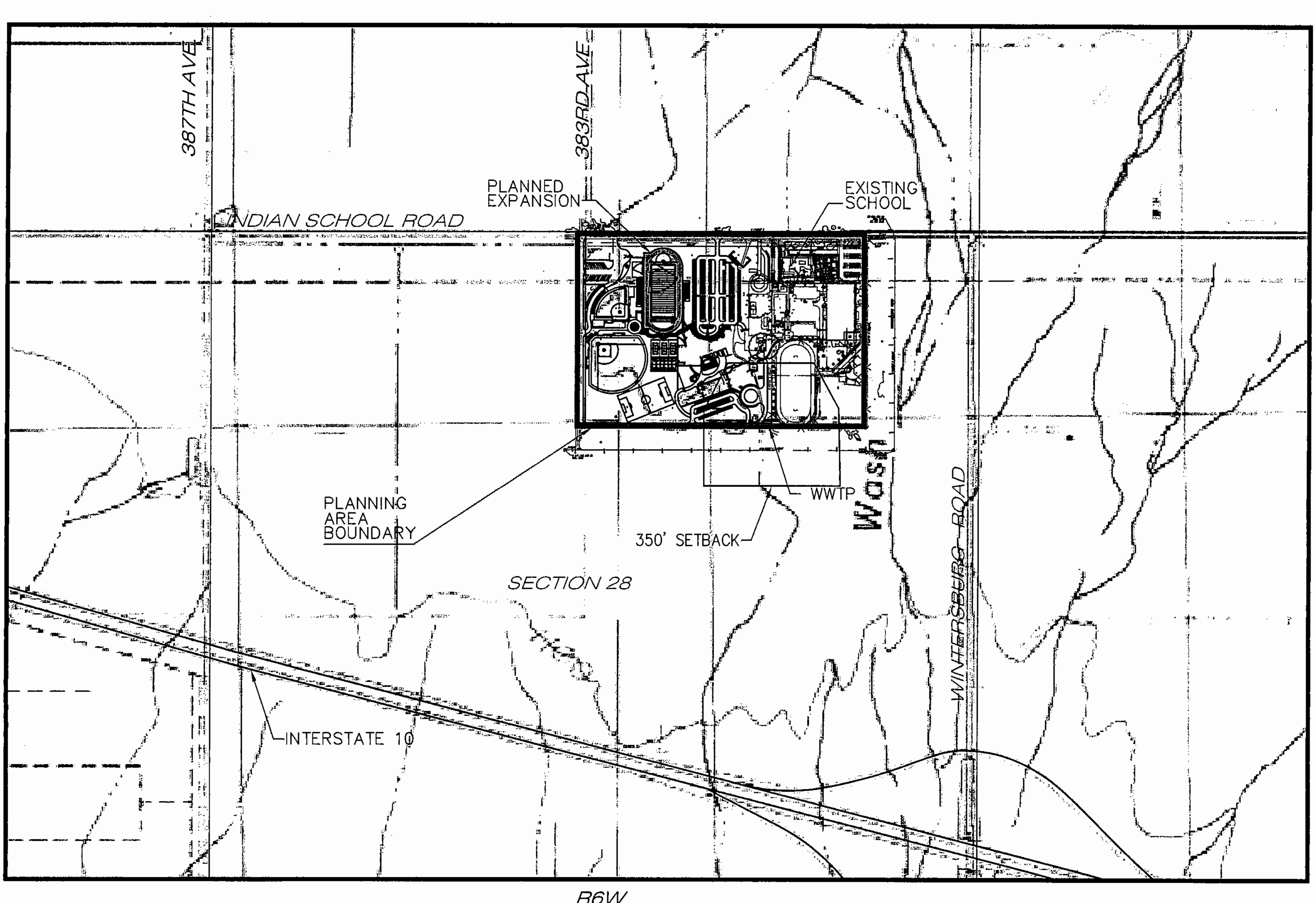
The school wastewater will be domestic from restrooms, showers, and the cafeteria facilities at the school. A grease trap is currently installed at the elementary school and new ones will be installed for the high school to prevent oils, fats, and greases from reaching the wastewater treatment plant.

Selection of Plant Capacity and Design

The school facilities currently provide K-8 classes for 350 students. The facility is being expanded to provide classes for up to 800 K-8 students and 650 high school students. The 670 square mile school district is planning for adequate classroom space as their student population increases. Table 1 shows the phasing and student population planned for the expanded school facilities. Further details are shown in the WWTP Design Concept Report in Appendix B.

Table 1
Ruth Fisher Schools Projected Water Demand and Wastewater Flow

Phase	Elementary K-8		High School		TOTAL
	Population	Average Day Demand	Population	Average Day Demand	Average Day Demand
Existing	350	17 gpm 8,050 gpd	0		17 gpm 8,050 gpd
Phase I	450	22 gpm 10,350 gpd	0		22 gpm 10,350 gpd
Phase II	800	38 gpm 18,400 gpd	650	47 gpm 22,750 gpd	85 gpm 41,150 gpd



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208 SMALL PLANT REVIEW AND APPROVAL

FIGURE 3 - PLANNING AREA BOUNDARY

Figure 4 shows the existing school facilities and the planned expansion of the facilities and location for the expanded wastewater treatment plant. The wastewater will be generated by the school restrooms, showers, cafeterias, and similar facilities.

The 42,000 gpd plant capacity will include equalization with enough volume to store the flow from the school day for a constant rate of treatment over 24 hours. The volume of wastewater projected is based on the historical water use records for the elementary school (22.75 gpd/student) for the elementary school expansion, and 35 gpd/student for the high school. The volume includes faculty and staff associated with the historical water use. These numbers are higher than the Aquifer Protection Permit rules require in Table 1 of AAC R18-9, after Section E323. Table 1 lists recommended volumes of 15 and 25 gpd/student for the elementary and high schools (with gym).

Table 2
Treatment Systems and Design Criteria

Capacity	42,000 gpd Average Flow at Buildout
Effluent Requirements	BOD_5 10 mg/l TSS 10 mg/l Total Nitrogen ≤ 10 mg/l (5 mo. Rolling geo. Mean) Fecal Coliform = 0 (7 sample median) and < 23 (single sample max) Turbidity ≤ 2 (24 hr ave.); never > 5
Headworks & Equalization	**Screening:** Sized for Peak Flow, Screen Opening Spacing 0.25-0.5 inches **Equalization/Influent Pumping:** Sized to dampen peak flow for buildout; 400 gpm Pump, 400 gpm Backup/Alternate Pump, 5 gpm Low Flow Pump **Flow Measurement:** 5 to 430 gpm
Secondary Treatment	**Anoxic Reactor:** 7,000 gallon **Aerobic Reactor:** 17,500 gallon **Internal Recycle:** 118 gpm **Secondary Solids Removal:** Membrane Bioreactor and Pumping to Waste **Waste Activated Sludge:** 1,460 gpd **Return Activated Sludge Recycle:** 11.5 gpm
Tertiary Treatment	**Filtration:** Tertiary Sand Filter or Membrane Bioreactor Ultrafiltration
Disinfection	**Chlorination/Dechlorination:** Providing a chlorine dose of 6 mg/l to disinfect the effluent using a tablet chlorinator. For water that will be recharged rather than reused, dechlorination will be provided.
Solids Treatment	**Stabilization:** Aerobic Digester; 20 to 30 days retention time, in existing aeration basin. **Dewatering:** Decanting and Bagging/Air Drying

The school wastewater treatment plant processes were chosen based on the space available and desired Class A+ quality desired as well as the cost. As shown in Table 4, the plant will consist of mechanical bar screen solids removal and equalization followed by an Ashbrook activated sludge nitrification-denitrification facility, and tertiary filtration followed by chlorination/dechlorination. The Ashbrook plant was

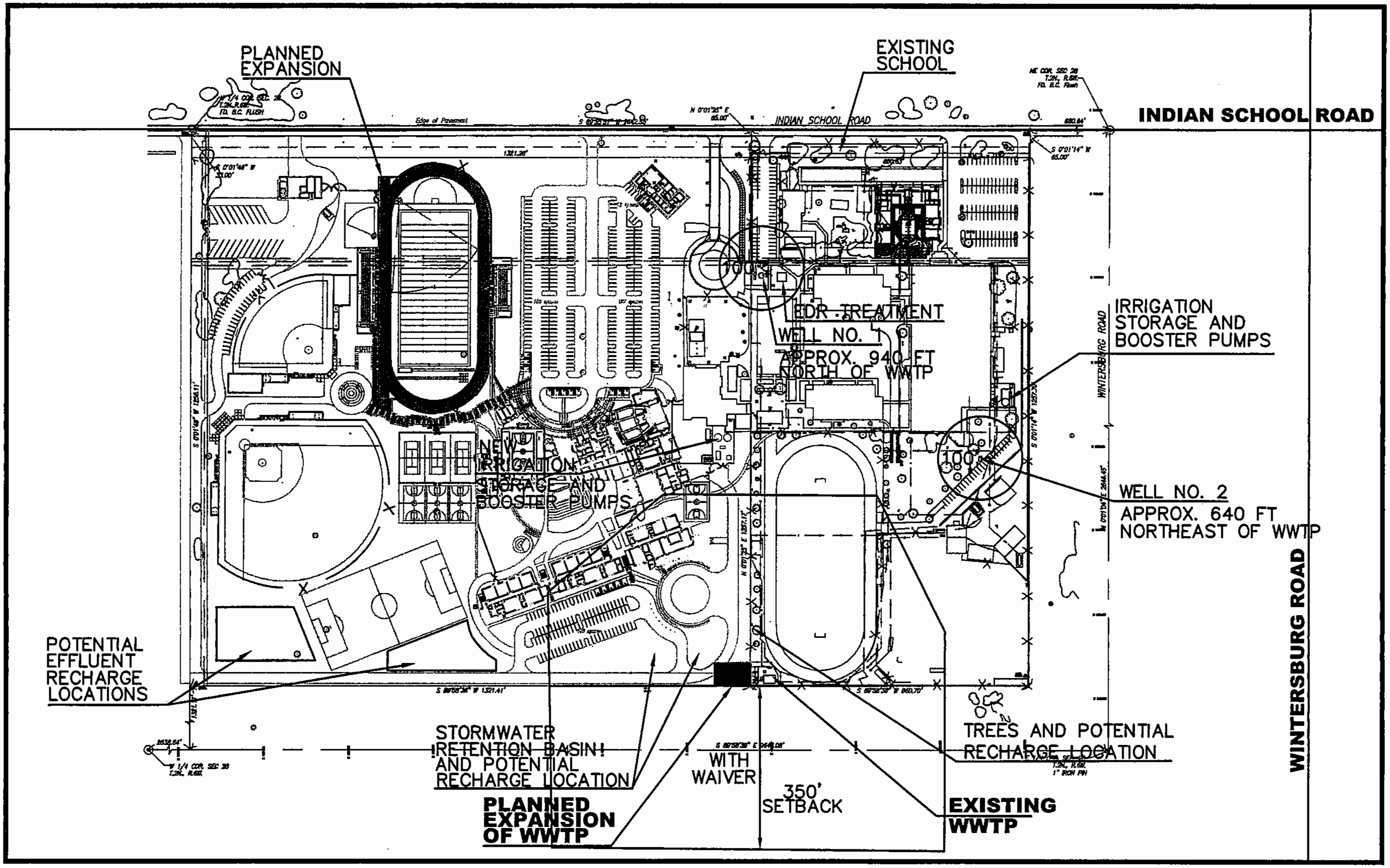

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FIGURE 4
EXISTING AND PROPOSED SCHOOL SITE

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compared to two other package activated sludge plants and membrane biofiltration. Based on cost and the limited school funds, the Ashbrook plant was chosen. The main difference of the Ashbrook system from the other activated sludge plants was the metal tanks for the treatment system instead of concrete basins. The metal tanks will be provided with corrosion protection to extend the life of the plant. The Ashbrook system is similar to the existing school wastewater treatment plant, which is extended aeration secondary treatment. The Ashbrook system will add nitrification and denitrification. Tertiarty filters will also be added. If designed and operated properly, the plant design meets the BADCT requirements and will produce an effluent that will meet Class A+ requirements. The proposed plant layout is shown in Figure 5.

Solids removed from the system will be pumped to the old aeration basin that will be converted to an aerobic digester. Settled solid in the digester will be dewatered and removed to be bagged using a Draemad system. The bags of sludge will be dried and hauled to a landfill for disposal. Using the biosolids as fertilizer was an option considered, but would require testing and record keeping which would be a burden to the school. It would also require more space than is available to store the bags.

Planning Criteria

Area Master Plans and Guidelines

The current 208 plan lists Ruth Fisher School as a small plant with 15,000 gpd capacity. The plant is located in an unincorporated portion of the County more than eight miles west of the nearest annexation by the Town of Buckeye and even farther from existing and planned development and treatment plants for Belmont and Douglas Ranch. A few scattered houses in the vicinity are located between farm fields and have on-site septic systems. No other treatment plants are planned in the area and no master plans have been completed.

If the nearby farm fields are developed, the plant land area would need to be expanded and additional treatment capacity added. It is unlikely that the school would own and operate a regional treatment plant. At that time it is likely a regional plant would be planned to serve the area.

Existing Land Use and Nearby Areas

The existing land around the school is either undeveloped desert or farm fields as shown in Figure 6. The expansion of the treatment plant will not affect the current land uses.

The zoning for land in the area, shown in yellow in Figure 7, is Rural-43 with the exception of three areas. They include a special use permit for the Cotton Gin northwest of the school, and two areas pending zoning changes along the interstate highway.

The nearby landowners' reactions t o the school expansion have been positive.

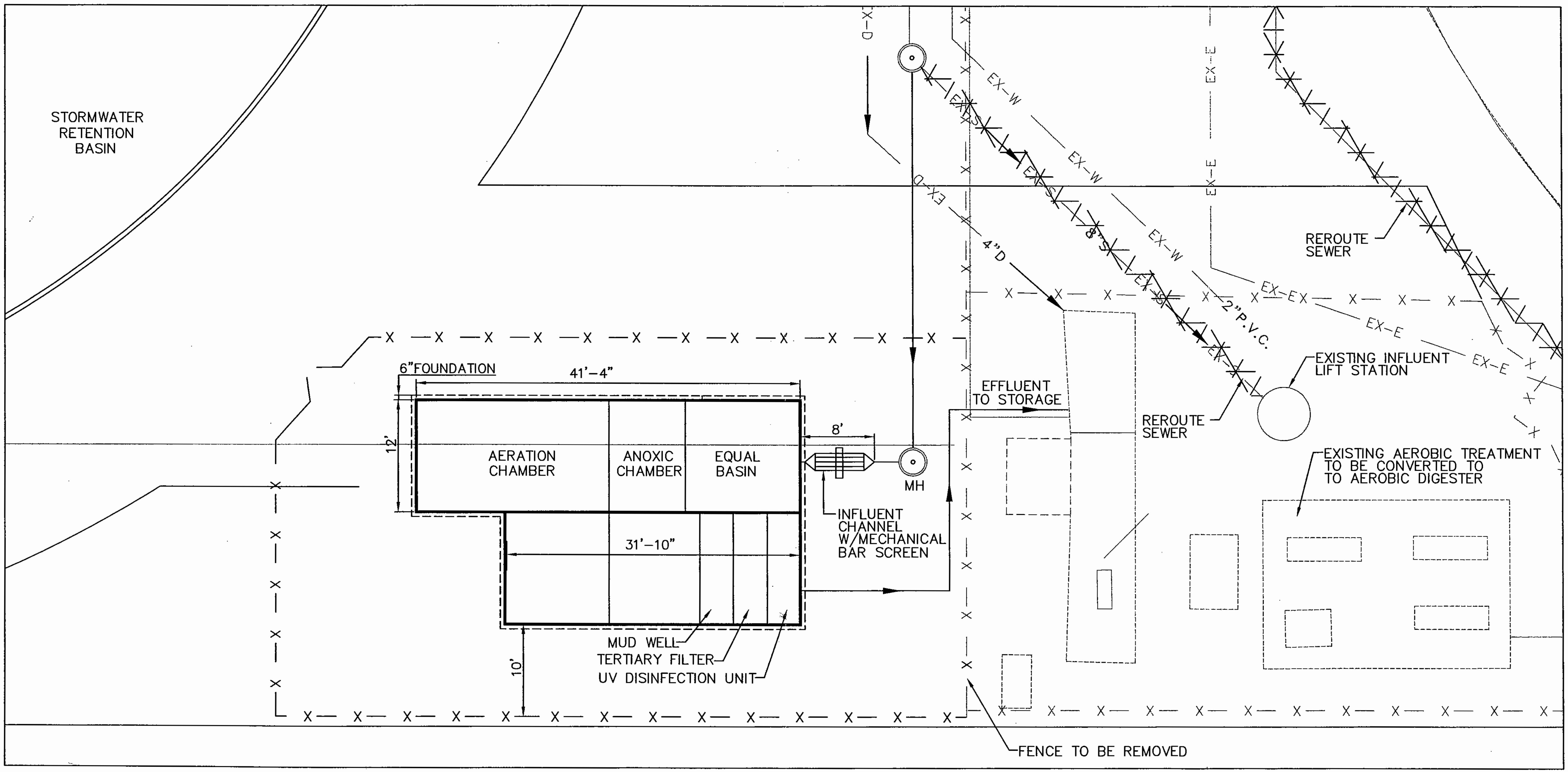

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FIGURE 5

ASHBROOK WASTEWATER TREATMENT PLANT PRELIMINARY LAYOUT

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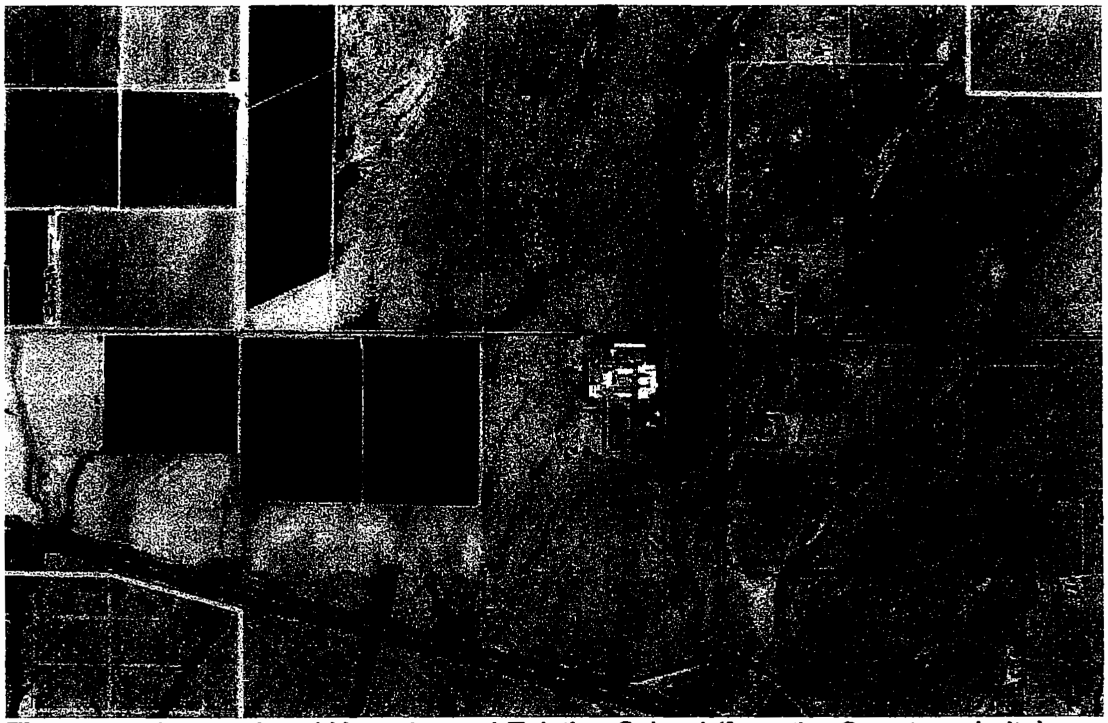

Figure 6 – Current Land Uses Around Existing School (from the County website)

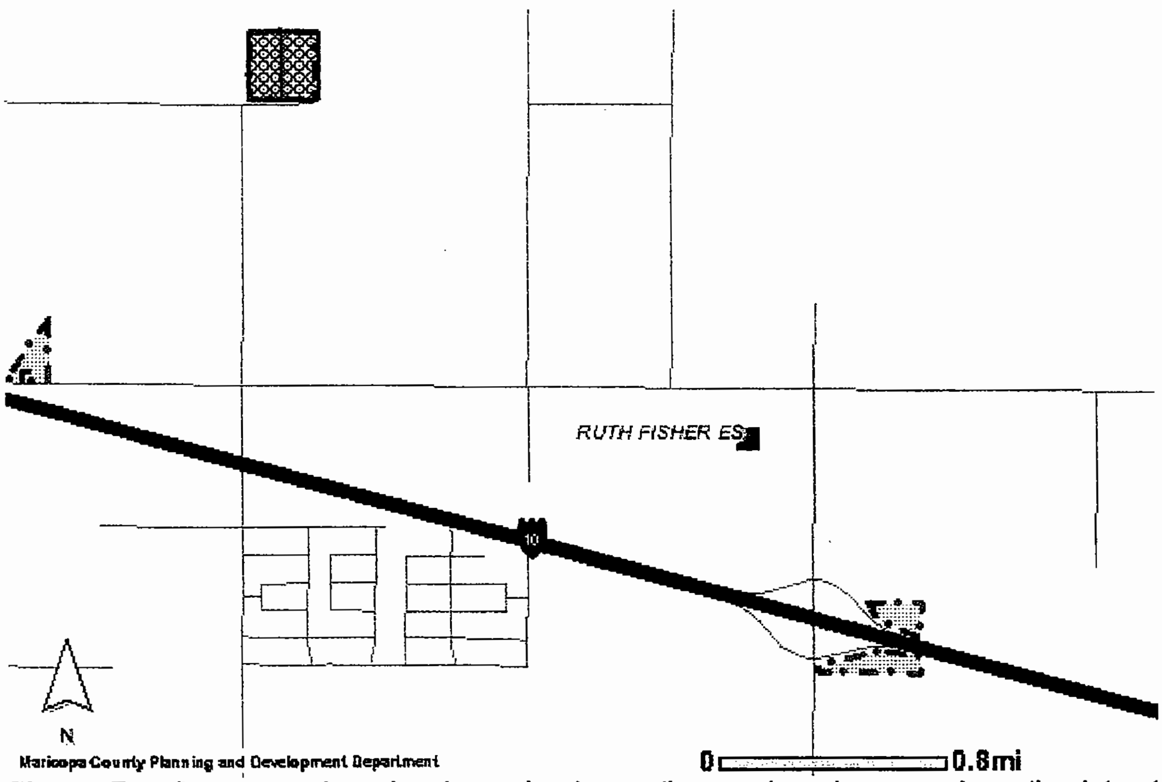

Figure 7 – County zoning showing school, pending zoning changes along the interstate highway, and the Cotton Gin northwest of the school. (From the County website)

Landscape Irrigation and Recharge of Effluent

The reuse of effluent will result in a net water savings instead of using groundwater for both potable water and landscaping for the expanded school facility. The water used for the school is pumped entirely from wells located on the property. The plant replacement and expansion will improve the effluent water quality used for landscape irrigation on the school ball fields allowing open access reuse. It will also allow for recharge of groundwater using the effluent. The net water savings is expected to be approximately 42,000 gpd for the average volume of reclaimed water reused for landscape irrigation.

Table 3 and the DCR in Appendix B describe the reuse and recharge conditions. Based on the results, the number of subsurface infiltration chambers for buildout of 42,000 gpd is estimated to be 350 units covering a one acre area. The effluent quality as required for recharge and reuse is summarized in Table 1-2 of the Design Concept Report found in Appendix B.

Table 3
Recharge and Reuse Conditions

Recharge	Subsurface Infiltration Chambers Adjacent to Plant Area: Estimated to be 350 chambers on 1 acre (includes 100% redundancy)
Reuse	Landscape Irrigation at the school

Development Criteria

Financing

The school district is funding the school expansion construction, including the wastewater treatment plant, using bond funds. A letter from the School District Superintendent is included in Appendix C.

Operations costs are built into the annual school budget. The operating costs for the expanded plant are estimated to be $93,000 per year. See Appendix D for the breakdown of the costs.

Operation

The existing certified operator is contracted by the school district. After the contract ends, the contract will be renewed or another certified operator will be contracted to operate the plant.

Appendix A

MAG Small Plant Review and Approval Process
Outside of Municipal Planning Area

4.3 MODIFICATIONS TO THE MAG 208 PLAN

The MAG 208 Plan is subject to change in accordance with these established procedures:

- Periodic Major Revision of the 208 Plan.
- 208 Plan Amendment Process.
- Small Plant Review and Approval Process.

Each of these procedures have been utilized multiple times since the original plan was developed.

4.3.1 Periodic Major Revision of the MAG 208 Plan

The MAG 208 Water Quality Management Plan is periodically updated in accordance with provisions of Section 208 of the Federal Clean Water Act. These updates to the original 208 Plan (July 1979) have been occurring on an approximate 10 year cycle (1982, 1993, and the current update to be completed in 2001/02).

4.3.2 Interim Revision of the MAG 208 Plan

Modifications to the MAG 208 Plan are incorporated in each update. Two procedures exist to modify the approved 208 Plan between revision cycles:

- 208 Amendment
- Small Plant Review and Approval Process

Each of these procedures is defined in detail in the following sections.

4.4 MAG 208 PLAN AMENDMENT REQUIREMENTS

Plants greater than 2.0 million gallons per day and those with a discharge requiring an NPDES permit or AZPDES permit which are not specifically identified in the MAG 208 Plan would be required to go through a formal 208 analysis or amendment.

For plants required to go through a formal 208 analysis and amendment, the jurisdiction (MAG member agency) in which the facility would be located initiates a request to include the new wastewater treatment plant in the 208 Plan. It is recommended that the jurisdiction making the request contact any adjacent community if the proposed development is within three miles of the boundary between the two communities.

According to federal regulations, public participation requirements are applicable for 208 Plan Amendments. The MAG Water Quality Advisory Committee reviews the draft 208 Plan amendment and then authorizes a public hearing to be conducted. The hearing must be advertised 45 days in advance and the document must be available for public review 30 days prior to the hearing. A hearing notice is also sent to interested parties 30 days prior to the public hearing. The public hearing is conducted by MAG. A court reporter prepares an official transcript of the hearing. If written or verbal comments are received, a response to comments is prepared by the entity requesting the amendment.

The MAG Water Quality Advisory Committee reviews the response to comments and then makes a recommendation to the MAG Management Committee. The MAG Management Committee reviews the recommendation from the Water Quality Advisory Committee and then makes a recommendation to the MAG Regional Council. As the decision-making body of MAG, the Regional Council reviews the recommendation from the Management Committee and then takes official action to approve the 208 Plan amendment.

The State Water Quality Management Working Group reviews the 208 Plan amendment approved by the Regional Council and then makes a recommendation the Arizona Department of Environmental Quality (ADEQ). ADEQ submits the 208 Plan amendment to the U.S. Environmental Protection Agency (EPA) for approval and EPA approves the 208 Plan amendment and notifies the State of the approval action.

The Arizona Department of Environmental Quality maintains a 208 amendment checklist for use in preparing 208 Plan Amendments. Copies of the current checklist can be provided by ADEQ upon request.

4.5 SMALL PLANT REVIEW AND APPROVAL PROCESS

4.5.1 Introduction

In the 1982 MAG Point Source Plan Update an altemative to continue expansion of the 91st Avenue WWTP and other major treatment plants was the construction of small reclamation plants. Rather than amend the MAG 208 Plan to include every acceptable new small plant, the communities developed a small plant review and approval process.

Using this process, a small plant not specifically identified in the Point Source Plan can be approved as part of the 208 Plan if the plant goes through the approved Small Plant Review and Approval Process. By requiring proposed plants in the area to obtain approval using this formal process, an uncontrolled proliferation of small plants that could cause problems in the future should be prevented. The communities adopted a small plant process goal of allowing the Cities and Towns the maximum level of control in the approval of small plants. A Small Plants Technical Steering Committee was formed in 1982, composed of representatives from the cities, state, county, and homebuilders. This committee, in conjunction with consultants and MAG staff, developed the Small Plant Review and Approval Process.

4.5.1.1 Small Plant Definition

A small plant is a reclamation plant with an ultimate capacity of 2.0 mgd or less with no discharge requiring an National Pollutant Discharge Elimination System or Arizona Pollutant

Discharge Elimination System permit. Plants greater than 2.0 mgd and discharges requiring an National Pollutant Discharge Elimination System or Arizona Pollutant Discharge Elimination System permit which are not specifically identified in the MAG 208 Plan would be required to go through a formal 208 analysis and amendment.

Small plants that are specifically identified in the MAG 208 Plan are required to go through the Small Plant Review and Approval Process for an expansion of the facility, even when the expanded facility would still meet the small plant threshold of 2.0 mgd or less.

4.5.1.2 Municipal Small Plant Planning Area Boundaries

For the purposes of the 208 Plan, the Municipal Small Plant Planning Areas are the same as the MAG Municipal Planning Areas (MPAs). The 27 MPAs generally correspond to the jurisdictions for which they are named. Minimally, the planning area for each city or town includes all of its incorporated area plus portions of the County surrounded by strip annexation to allow municipalities to plan for those unincorporated areas.

4.5.1.3 Areas of Responsibility

Three areas of responsibility are defined. One is the Municipal Small Plant Planning Area. This is the area identified by the municipality within which the City or Town would have responsibility for the first review and approval of proposed wastewater facilities. The second area is the County Planning Area and within this area, the County would have the responsibility for deciding which wastewater facilities were constructed.

Between the two areas is a third area. This is the area in the County that is within three miles of a Municipal Small Plant Planning Area. Although this area is within the County's area of responsibility, the County must consider the comments of the nearby City or Town concerning proposed facilities in this three-mile area. Figure 4.31 schematically illustrates the relationship between the three areas of responsibility.

4.5.1.4 Review and Approval Process

In the process developed for a proposed facility within a Municipal Small Plant Planning Area, the City or Town would work with a developer to come up with a suitable small plant concept. When an acceptable concept has been worked out, the City would send a letter to MAG stating that the proposed small plant is in keeping with the City's wastewater plans for the area.

MAG would then review the proposal and send a letter to the Arizona Department of Environmental Quality (ADEQ) stating whether the small plant is compatible with the overall 208 Plan. The ADEQ has the legal authority to identify compliance with the 208 Plan. Therefore, the final 208 letter of compliance must come from ADEQ. This letter would go to the developer and the Maricopa County Environmental Services Department (MCESD). Upon receiving an approval letter, MCESD would review the plans and specifications for the construction of the wastewater system in the proposed development.

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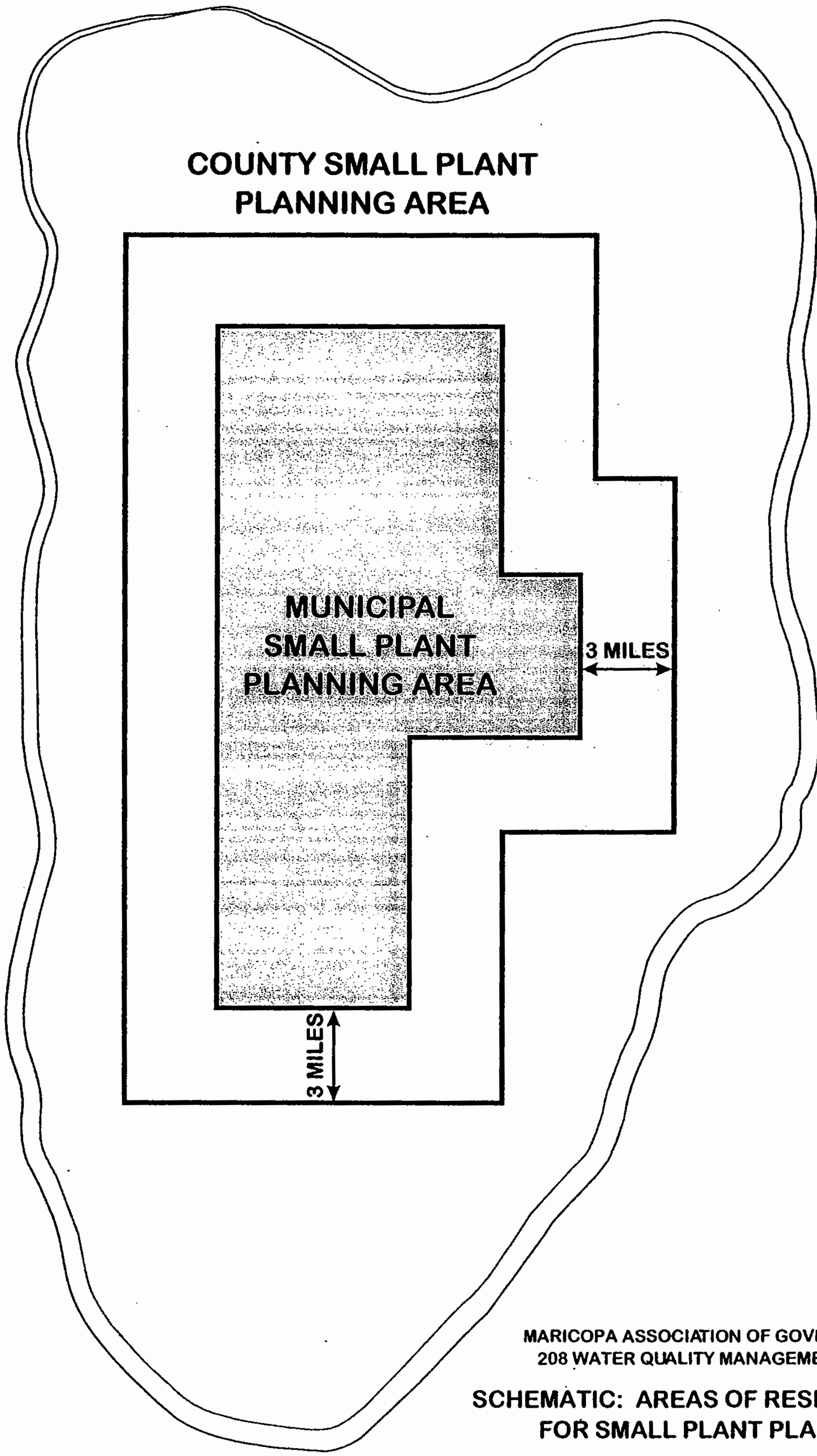

MARICOPA ASSOCIATION OF GOVERNMENTS
208 WATER QUALITY MANAGEMENT PLAN

SCHEMATIC: AREAS OF RESPONSIBILITY FOR SMALL PLANT PLANNING

CAROLLO ENGINEERS
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Should a developer not be able to work out the details of its proposed small plant with the particular City or Town, it would not be able to proceed. The County would not approve the plans and specifications without the compliance letter from the ADEQ. The state will not give a letter of compliance unless they receive the approval letters from the City and MAG. In accordance with R18-9-B201(H), the Arizona Department of Environmental Quality shall not publish a Notice of Preliminary Decision to issue an individual permit or amendment for a sewage treatment facility that is not in conformance with the Certified Areawide Water Quality Management Plan and the Facility Plan (see the Appendices). For a proposed project in the County, the County would play the same role as the City in the early project review and development. Projects within three miles of a Municipal Small Plant Planning Area would be reviewed and commented on by the affected City or Town. Projects with major problems to the City or Town which could not be resolved, would not receive compliance from ADEQ. The specific process adopted in the MAG 208 Plan in 1982 is set forth below.

4.5.2 MAG Small Plant Process

No wastewater treatment plant greater than 2.0 mgd ultimate capacity is considered to be in compliance with this plan unless it is specifically named in the Plan or added through 208 Plan Amendments.

Wastewater treatment plants with an ultimate capacity of 2.0 mgd or less are considered to be in compliance with this plan if they are approved using the following processes:

1. <u>Within Municipal Planning Area</u>

   To be approved for construction, a small wastewater treatment plant (2.0 mgd ultimate capacity or less) not otherwise mentioned in the MAG 208 Plan but located within a Municipal Small Plant Planning Area must:

   1. Have the approval of the municipality in whose planning area it will be located;

   2. Not adversely affect the operation or financial structure of existing or proposed wastewater treatment plants;

   3. Be consistent with State and County regulations and other requirements; and,

   4. Be otherwise consistent with the MAG 208 Plan.

   The process for approval of a small plant is as follows:

   1. Developer prepares an engineering report on the proposal and submits the report to the City.

2. City reviews the proposal based upon the guidelines in the attached list (Table 4.52) and any others depending upon the needs and desires of the specific City or Town. If the City or Town does not have the staff capability to perform this review, the review process used would be that for small plants outside a Municipal Planning Area. It is also recommended that the City or Town reviewing a proposed development contact any adjacent community if the proposed development is within three miles of boundary between the two communities.

Table 4.52 **Guidelines for Small Plants Within Municipal Small Plant Planning Area** **MAG 208 Water Quality Management Plan Update**
1) Plant Justification • Why Plant is Required - Limited capacity at existing plant or sewer - Too far from trunk sewer - Temporary plant - Soil limitations - Effluent reuse or water conservation - Sludge management options - Other
• Master Plan Compatibility - Is plant compatible with future plans for the area? - Will proposed plant impact existing or proposed plants? - Will proposed plant impact existing or proposed reuse plans in the region?
• Benefits of Plant - Net water saving - Delays major capital expenditures - Better scheduling and project control - Allows development
• Potential Problems - High capital and operational costs - Impacts on groundwater - Impacts on surface water - Inability to meet State regulations - Financial failure of operation - Poor operation and maintenance (O&M)

Table 4.52	Guidelines for Small Plants Within Municipal Small Plant Planning Area MAG 208 Water Quality Management Plan Update
•	Financial - Who will fund construction? - Who will fund O&M costs - short term? - Who will fund O&M costs - long term? - Financial security
•	Operation - Who will operate plant - short term? - Who will operate plant - long term?

3. If the proposal fits into the City's Master Plan, then the City sends a letter and a summary of the proposal to MAG (copy to the developer) stating the proposal is approved by the City and it is compatible with the 208 Plan covering the City's Planning Area.

4. MAG reviews the proposal for overall 208 Plan compliance to ensure that the Small Plant Process is followed, and to ensure that regional impacts are addressed. This evaluation will be coordinated by the MAG Water Quality Advisory Committee. Recommendations from the Water Quality Advisory Committee will be presented to the MAG Management Committee. Recommendations from the Management Committee will be presented to the Regional Council.

5. Based on Regional Council actions, MAG sends a letter to ADEQ and the proposal summary (copies to developer, City, and MCESD) stating whether the proposed project is compatible with the overall 208 Plan.

6. Upon receipt and review of the letter from MAG, ADEQ submits a letter and proposal summary to MCESD and developer stating whether the proposed project is in conformance with the MAG 208 Plan.

7. The developer, after receiving an approval letter from ADEQ, submits plans and specifications to MCESD for review together with a copy of the approved design concept.

8. MCESD reviews, based on ADEQ Bulletin #11 and County regulations, the plans and specifications and issues permit to construct.

For the purpose of this process, a Sanitary District is treated in the same fashion as a Municipality.

2. Outside of Municipal Planning Areas

To be approved for construction, a small wastewater treatment plant (2.0 mgd ultimate capacity or less) not otherwise mentioned in the MAG 208 Plan and located outside a Municipal Small Plant Planning Area must:

1. Have the review and comment of any municipality whose Small Plant Planning Area is within three miles of the proposed plant location or service area;

2. Not adversely affect the operation or financial structure of existing or proposed wastewater treatment plants;

3. Be consistent with State and County regulations and other requirements;

4. Be otherwise consistent with the MAG 208 Plan; and,

5. Be evaluated and approved, or modified by Maricopa County Environmental Services Department (MCESD).

The process for approval of a small plant is as follows:

1. Developer submits engineering report to Maricopa County and any cities whose Municipal Small Plant Planning Areas are within three miles of the proposed plant's service areas. This report would contain sufficient information for evaluation of the report based upon the attached guidelines as set forth in Table 4.53.

Table 4.53 Criteria for Feasibility Report for Small Plants Outside of Municipal Small Plant Planning Area **MAG 208 Water Quality Management Plan Update**
1) Technical Criteria • Why is small plant desired? - Depth to groundwater less than _____ ft. - Soil limitations prevent use of septic tanks - Potential for reuse or water conservation - Lot size one acre or less - Area not planned for regional service for ______ years - Density of projected population - Will serve industrial or commercial area

Table 4.53 (con't.)	Criteria for Feasibility Report for Small Plants Outside of Municipal Small Plant Planning Area MAG 208 Water Quality Management Plan Update
	• What is the anticipated quality of the wastewater? - Domestic - Commercial and/or Industrial - If commercial and/or industrial wastes are anticipated, what provisions are being taken to ensure no toxic substances will be discharged?
	• How and why was small plant design and capacity selected? - What criteria were used? - What alternatives were considered? - What are benefits, problems of alternatives? - Will there be problems meeting State or County regulations? - What sludge management options were considered?
2)	Planning Criteria • Is proposed plant compatible with County adopted master plans, guidelines, etc., for the area? - What plans apply? - What guidelines or policies apply?
	• Can the proposed plant be expanded to serve growing population? - What population is projected for the service area? - Would certain areas lend themselves, topographically or hydrologically, by planned use or density to being included in the service area?
	• Will proposed plant adversely impact existing or approved nearby land uses? - What are land uses within ______ miles? - What is zoning for the surrounding area? - What are reactions of nearby landowners to proposed facility?
	• Will there be a net water saving from effluent reuse? - How will effluent be disposed of? - What is the estimated water saving?
	• Do nearby existing or proposed land uses indicate a need for a larger capacity sewage plant than that proposed? - Should nearby areas be sewered or otherwise join the proposed plant for water quality or economic reasons? - Do these areas wish to join the proposed plant?

Table 4.53 (con't.)	Criteria for Feasibility Report for Small Plants Outside of Municipal Small Plant Planning Area MAG 208 Water Quality Management Plan Update
3)	Development Criteria • Who will fund construction? • Who will fund operation and maintenance costs? • Is there adequate financial security to assure continual and proper operation and maintenance? • Who will operate and maintain the plant and system? • What are anticipated capital and operation and maintenance costs?

2. The involved Cities evaluate the report and send a letter containing their recommendations to Maricopa County (copies to MAG and developer).

3. Maricopa County incorporates City's concerns and sends a letter and summary of the proposal to MAG (with copies to involved Cities and developers), stating whether the proposal for wastewater is acceptable to the County.

4. MAG evaluates the proposed plant for overall MAG 208 Plan conformance to ensure that the Small Plant Process is followed and to ensure that regional impacts are addressed. This evaluation will be conducted by the MAG Water Quality Advisory Committee. Recommendations from the Water Quality Advisory Committee will be presented to the MAG Management Committee. Recommendations from the MAG Management Committee will be presented to the Regional Council. Based upon Regional Council action, MAG submits letter on 208 compliance to ADEQ (with copies to Maricopa County, the developer and any involved cities).

5. After review of the MAG Submittal, ADEQ submits letter to MCESD (with copy to the developer) indicating 208 Plan compliance.

6. After receipt of an approval letter from ADEQ, MCESD reviews and approves plans and specifications based upon Bulletin # 11 and issues permit to construct.

It should be noted that before a development proceeds, approval has to be obtained for the entire master plan. Approval by the State and County Departments only constitutes one part of the approval process.

Appendix B

Wastewater Treatment Plant Design Concept Report

Saddle Mountain Unified School District

Ruth Fisher School

Wastewater Treatment Plant Design Concept Report

February 2004
Revised June 2004
Revised August 2004
Revised October 2004

Prepared for:

Ruth Fisher School
Saddle Mountain Unified School District No. 90
38201 W. Indian School Road
Tonopah, Arizona 85354

Through:

Hubbard Engineering
625 N. Gilbert Road
Gilbert, Arizona 85234

Prepared by:

Fluid Solutions
Water • Wastewater • Engineering • Environmental Services
1121 East Missouri Avenue, Suite 100, Phoenix, Arizona 85014

Design Concept Report

For

Ruth Fisher School
Wastewater Treatment Plant

Prepared For:

Ruth Fisher School

Through:

Hubbard Engineering

Registered Professional Engineer (Civil)
CERTIFICATE NO.
31118
KATHRYN H.
MILLS
Date Signed 10-1-04
ARIZONA U.S.A.

February 2004
Revised June 2004
Revised August 2004
Revised October 2004

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

This report serves as the design report for expansion of the wastewater treatment facilities at Ruth Fisher School in Maricopa County near Tonopah, Arizona. The report summarizes projected wastewater flow that may be generated by the expanded school facilities, methods for effluent disposition, required permitting, and required treatment systems. Capital costs are provided for the new treatment plant.

1.1 Planning

The existing school WWTP treats water to secondary levels for consumptive reuse irrigation on the school grounds. It is not sized to meet the future demands of the schools as currently planned. Instead of upgrading the existing WWTP, a new facility will replace it to treat the water to Class A+ effluent for open access landscape irrigation and groundwater recharge of excess effluent. The effluent will exceed the turf water requirements during the winter and be recharged in the vicinity of the school.

The school is located in Tonopah, Arizona, a small community located approximately 54 miles west of Phoenix. The site is located in Section 28, T2N, R6W, just north of Interstate 10 at the Wintersburg Road exit. The location is shown on the vicinity map, Figure 1. Figure 2 shows the school grounds, existing and proposed buildings, and proposed treatment plant location.

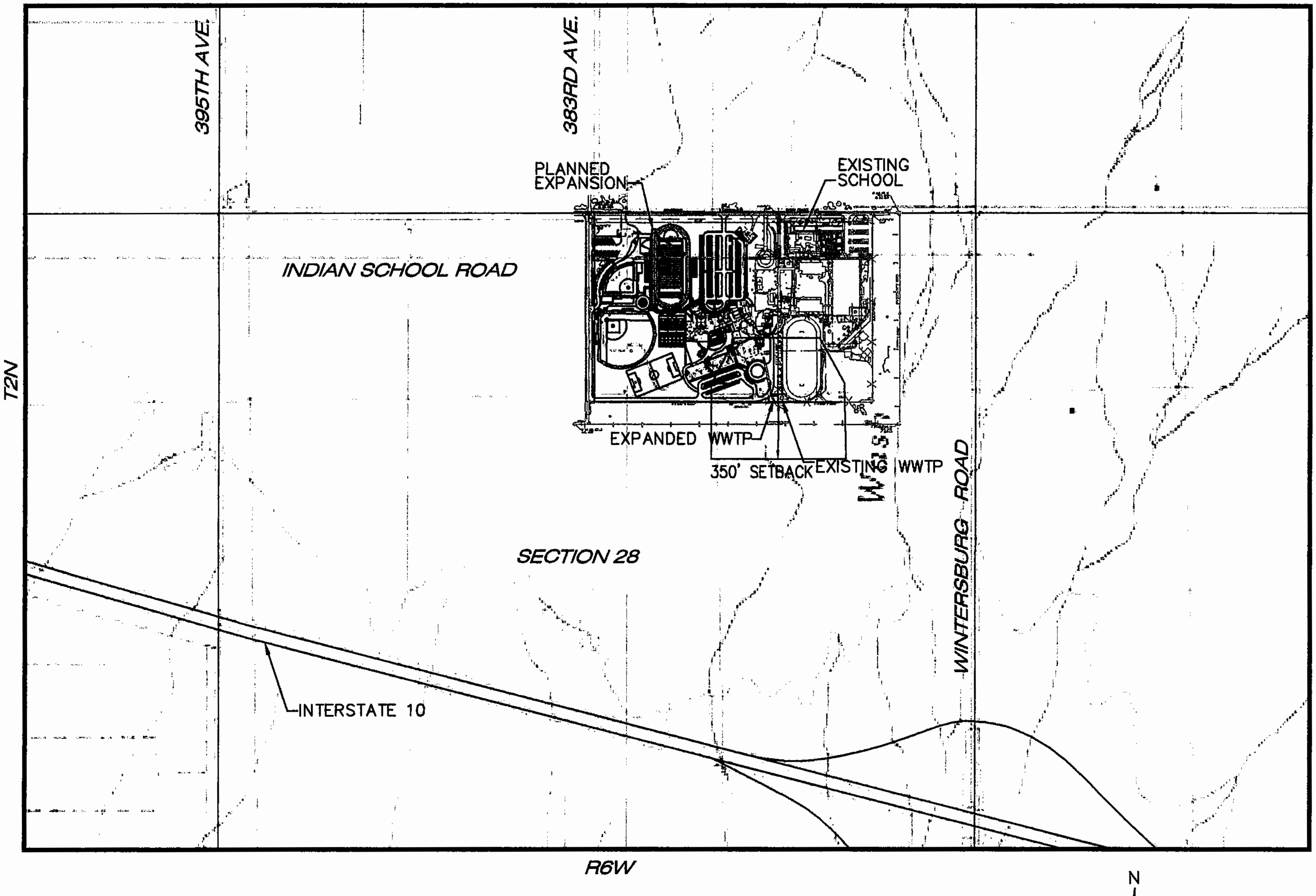
End uses of the treated effluent were evaluated prior to evaluation of the treatment methods to ensure that the treatment could meet end use requirements in a cost-effective manner. These uses included reuse and recharge. Proposed reuse is on the turf and ball fields and other landscaping within the school grounds. Recharge was reviewed through infiltration basins and percolation chambers on the school site. Discharge was not considered due to the lack of surface waters and canals suitable for receiving these flows. Through review of these alternatives it was determined that reuse for turf and landscaping irrigation with recharge of excess effluent would be the best option.

1.2 Regulatory Requirements

The permit required to complete this project include an individual Aquifer Protection Permit (APP) from the Arizona Department of Environmental Quality (ADEQ), which includes the Reuse Permit. In addition, an Approval to Construct and Approval of Construction will be required from Maricopa County Environmental Services Department (MCESD).

1.3 Treatment

The effluent water quality must meet the requirements of Class A+ for reuse and recharge to groundwater. Table 1-2 summarizes the effluent quality requirements.



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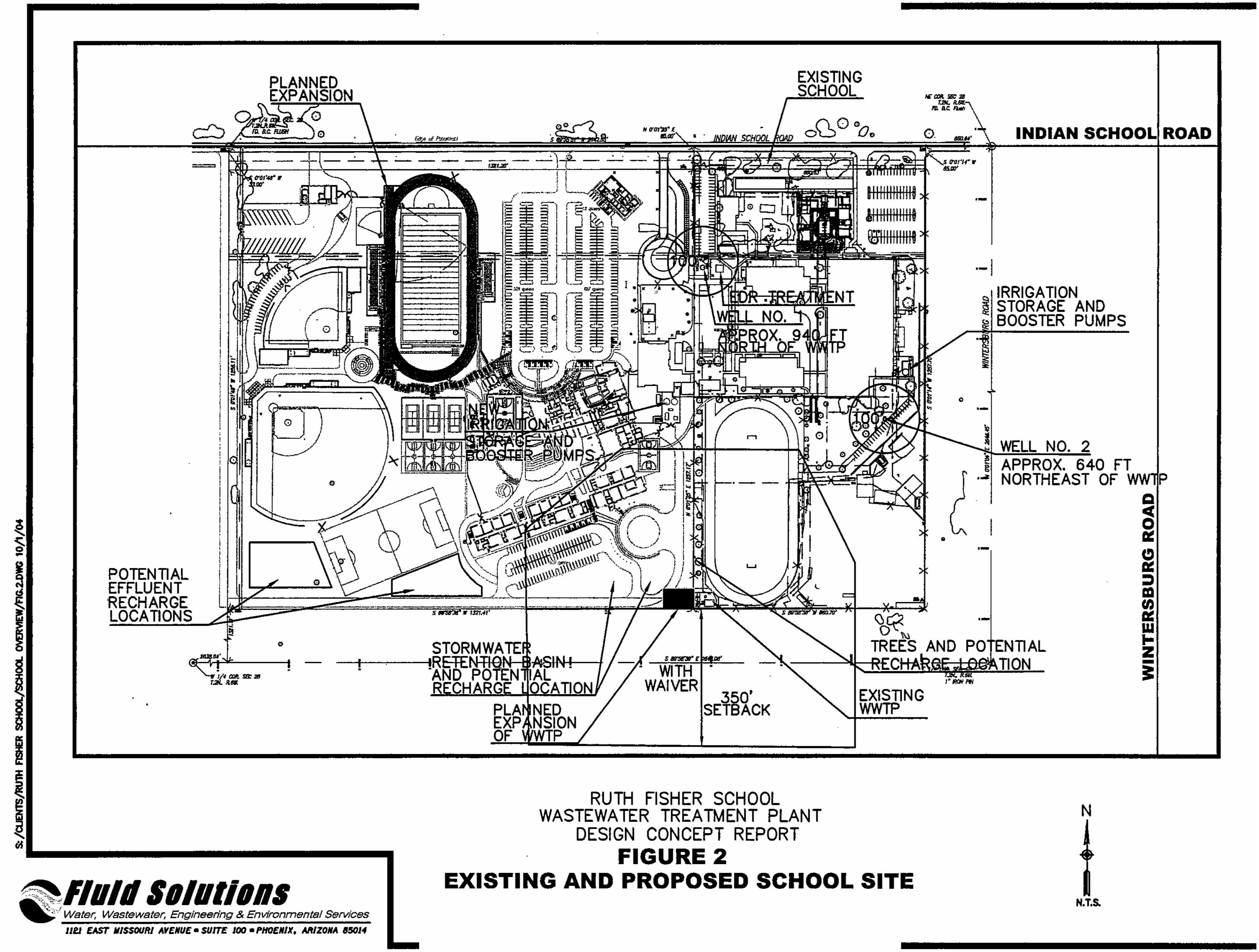
RUTH FISHER SCHOOL
WASTEWATER TREATMENT PLANT
DESIGN CONCEPT REPORT

FIGURE 1 - VICINITY MAP



RUTH FISHER SCHOOL
WASTEWATER TREATMENT PLANT
DESIGN CONCEPT REPORT

FIGURE 2

EXISTING AND PROPOSED SCHOOL SITE

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Table 1-2
Required Effluent Quality

Standards for Inorganic Chemicals

Pollutant	Concentration Limit (milligrams per liter [mg/l])	Pollutant	Concentration Limit (mg/l)
Antimony	0.006	Lead	0.05
Arsenic[1]	0.05	Mercury	0.002
Asbestos	7 million fibers/liter (longer than 10 μm)	Nickel	0.1
Barium	2.0	Nitrate (as N)	10
Beryllium	0.004	Nitrite (as N)	1
Cadmium	0.005	Total Nitrate and Nitrite (as N)	10
Chromium	0.1	Selenium	0.05
Cyanide (as Free Cyanide)	0.2	Thallium	0.002
Fluoride	4.0		

(1) Arsenic new standard 0.010 mg/l effective January 2006 and may affect future APP requirements.

Standards for Organic Chemicals

Pollutant	Concentration Limit (mg/l)	Pollutant	Concentration Limit (mg/l)
Benzene	0.005	Hexachlorocyclopentadiene	0.05
Benzo (A) pyrene	0.0002	Monochlorobenzene	0.1
Carbon Tetrachloride	0.005	Pentachlorophenol	0.001
o-Dichlorobenzene	0.6	Styrene	0.1
para-Dichlorobenzene	0.075	2,3,7,8-TCDD (Dioxin)	0.00000003
1,2-Dichloroethane	0.005	Tetrachloroethylene	0.005
1,1-Dichloroethylene	0.007	Toluene	1.0
cis-1,2-Dichloroetheylene	0.07	Trihalomethanes (Total)	0.10
trans-1,2-Dichloroethylene	0.1	1,2,4-Trichlorobenzene	0.07
1,2-Dichloropropane	0.005	1,1,1-Trichloroethane	0.20
Dichloromethane	0.005	1,1,2-Trichloroethane	0.005
Di (2-ethylhexyl) adipate	0.4	Trichloroethylene	0.005
Di (2-ethylhexyl) pthalate	0.006	Vinyl Chloride	0.002
Ethylbenzene	0.7	Xylenes (Total)	10.0
Hexachlorobenzene	0.001		

Table 1-2
Required Effluent Quality (Continued)

Standards for Pesticides and Polychlorinated Biphenyls (PCBs)

Pollutant	Concentration Limit (mg/l)	Pollutant	Concentration Limit (mg/l)
Alachlor	0.002	Glyphosate	0.7
Atrazine	0.003	Heptachlor	0.0004
Carbofuran	0.04	Heptachlor Epoxide	0.0002
Chlordane	0.002	Lindane	0.0002
1,2-Dibromo-3-Chloropropane (DBCP)	0.0002	Methoxychlor	0.04
2,4-Dichlorophenoxyacetic Acid (2,4-D)	0.07	Oxamyl	0.2
Dinoseb	0.007	Picloram	0.5
Diquat	0.02	Polychlorinated Biphenyls (PCBs)	0.0005
Endothall	0.1	Simazine	0.004
Endrin	0.002	Toxaphene	0.003
Ethylene Dibromide (EDB)	0.00005	2,4,5-Trichlorophenoxypropionic Acid (2,4,5-TP or Silvex)	0.05

Standards for Radionuclides

Pollutant	Contaminate Limit (pCi/l)
Gross Alpha (including Radium-226, excluding radon and uranium)	15.0
Combined Radium-226 and Radium-228	5.0
Average Annual Beta Particle	4.0 millirem/year

Standard for Microbiological Contaminants

Pollutant	Contaminate Limit
Total Coliforms	0 per 100 ml

Table 1-2
Required Effluent Quality (Continued)

Standards for Turbidity

Turbidity	Contaminate Limit (NTU)
Monthly Average	1
Two Consecutive Day Average	5

The individual unit process components that are required include the following:

Influent Pumping & Headworks	Screening Equalization Basin Influent Pumping Flow Measurement
Secondary Treatment	Anoxic Basin Aeration Basin Internal Recycle Return Activated Sludge Recycle and Waste of Activated Sludge
Tertiary Treatment	Filtration
Disinfection	Chlorination/Dechlorination
Solids Treatment	Digester Stabilization Dewatering

An extended aeration activated sludge membrane bioreactor package plant with nitrification and denitrification was reviewed along with standard extended aeration activated sludge package plants. The secondary processes from four different manufacturers were compared. Operation of the activated sludge plants is similar to the existing extended aeration plant making the change simpler for the existing operators. The estimated costs for the treatment system are provided in Table 1-3.

Table 1-3
Estimated Capital Cost for new WWTP

WWTP Cost	Total 42,000 gpd
Project Capital	$530,000
Cost/Gallon	$12.62
Reuse and Recharge	$74,000

Notes: Costs are shown in 2004 dollars. Recharge costs are based on an assumed infiltration rate of 6 inches per day using infiltration chambers below the surface. Reuse costs do not include the irrigation system.

1.4 Schedule

It is estimated that the new plant will be installed and ready for treating wastewater in approximately 6 months after permitting and shop drawings are complete. The timeline is based on conditions where design is completed to obtain permits, and permits are completed to construct. Current estimates indicate that the plant will be ready for construction in early 2005, and ready to operate for the fall school year in 2005.

2.0 PROJECT DESCRIPTION

2.1 Purpose

This report has been prepared as a design concept for the replacement wastewater treatment facility to serve the expansion of the school facilities. It identifies and lays out the preliminary components of the treatment system prior to the design with preliminary estimates of capital costs. The report will be used for the small plant amendment to the regional 208 plan and it will accompany the plans and specifications for permitting construction, effluent reuse and recharge activities of the facility.

Currently, the school is an elementary school serving grades K-8 for up to 350 students. Expansion of the school is planned to provide for up to 800 elementary K-8 students and 650 high school students, with new buildings and facilities as shown in Figures 1 and 2. The existing extended aeration WWTP provides secondary treatment for a capacity of 15,000 gpd and is capable of a Class B effluent. The effluent is consumptively reused for landscape irrigation under existing reuse permit #R102439. The small plant size, 15,000 gpd, fell under the prior General Aquifer Protection Permit upper limit of 20,000 gpd. The expansion of the schools will result in effluent that exceeds the required water for the turf during winter months. Recharge will be required and will require a process upgrade. As a result, a new WWTP is planned for the school expansion. The new flow volume will exceed the General Permit limit and the facility will require an individual Aquifer Protection Permit.

2.2 Scope

The scope of this project is to prepare a report that outlines the following parameters:

- Water quantity to be generated by the school expansion,
- Acceptable end use or disposal methods of effluent,
- Water quality required for acceptable effluent disposition,
- Design criteria for each unit process component to treat the determined volume to the required quality for effluent disposition,
- Preliminary size of facilities required for the method of discharge,
- Biosolids treatment and handling facilities,
- Site requirements of treatment facility to meet local noise and odor considerations, and
- Preliminary estimate of capital costs of improvements.

2.3 Background

The school is located in the east half of Section 28, T2N, R6W. As shown in Figure 1, the development is less than one mile north of Interstate 10 on Indian School Road, just west of Wintersburg Road. The school is within the bounds of Maricopa County, in Tonopah, Arizona.

Ruth Fisher School is being expanded for additional Kindergarten-8th Grade students and adding a high school. The capacity of the wastewater treatment system must be increased to meet the increased wastewater flow. The quality of the effluent must be improved to allow recharge of excess effluent.

3.0 Existing WWTP

3.1 Historic Wastewater Quality and Flows

No data was available from the wastewater treatment plant. Reports on effluent quality submitted to ADEQ as required for reuse showed samples with BOD and TSS below 10 mg/l.

3.2 Existing Treatment System and Permits

The existing treatment plant provides extended aeration treatment for closed access reuse, Permit #R102439. The treatment plant operates under Maricopa County permit number 37173.

3.3 Existing Effluent Disposition

The existing effluent is mixed with blowdown from the water treatment plant and reused to irrigate landscaping. Well water is also used for irrigation when the effluent quantity is less than the landscaping requires.

4.0 PROPOSED WWTP REPLACEMENT

4.1 Flow Projections

Wastewater flow potential is based directly on the number of students attending the school. The existing student population is approximately 350 elementary K-8 students. The projected water use demands are assumed to be similar to the volume of wastewater generated at the school, minus the blowdown waste stream from the water treatment plant, as shown in the following table:

Table 4-1
Ruth Fisher Schools Projected Water Demand and Wastewater Flow

Phase	Elementary K-8		High School		TOTAL
	Population	Average Day Demand	Population	Average Day Demand	Average Day Flow
Existing	350	17 gpm 7,963 gpd 22.75 gpcd	0		17 gpm 8,050 gpd
Phase I	450	22 gpm 10,238 gpd 22.75 gpcd	0		22 gpm 10,350 gpd
Phase II	800	38 gpm 18,200 gpd 22.75 gpcd	650	47 gpm 22,750 gpd 35 gpcd	85 gpm 40,950 gpd 22.75 gpcd and 35 gpcd

Note: Projected flows are based on water use records for the existing elementary school. Total water use was divided by number of students resulting in 22.75 gpcd. This includes water used by faculty and staff. AAC R18-9-Table 1 lists school demands as 15 gpcd for elementary schools and 28 gpcd for high schools with showers and cafeteria. Higher values were used for this project.

The wastewater treatment plant will be sized at 42,000 gpd to handle these water use projections. Equalization will address both biochemical and hydraulic peaking.

The blowdown from the water treatment system will be added to the effluent for reuse and recharge. The blowdown will add 35% to the treated effluent flow volume, resulting in 55,000 gpd.

4.2 Loading Projections

In addition to the amount of wastewater that must be handled hydraulically, there are nutrient and contaminant loads that must be removed from the liquid stream during the treatment process. Loading criteria will be based on accepted industry standards. Table 4-2 summarizes the design parameters listed in standard references. Additionally, this table identifies the loading criteria that will be used for this design with consideration for the effects of water conservation activities.

Table 4-2
Ruth Fisher School Loading Projections

Influent Parameter	Strong Domestic Sewage (mg/l)	Weak Domestic Sewage (mg/l)	Design Criteria (mg/l)
Suspended Solids (total)	350	100	250
Suspended Solids (volatile)	275	70	250
BOD_5 (@ 20°C)	300	100	300
Organic Carbon (total)	300	100	220
COD	1000	250	660
Nitrogen (total as N)	85	20	40
Organic Nitrogen	35	8	15
Ammonia (as NH_3)	50	12	25
Alkalinity (as $CaCO_3$)	200	50	180
Grease	150	50	100

Loads identified in the table above reflect a medium to slightly above medium strength domestic wastewater because of expected low flow fixtures. This data will be used to ensure that the unit processes are sized with sufficient microorganism retention, oxygen, and recycle rates.

4.3 Treatment Plant Site

4.3.1 Setbacks

The existing WWTP is located along the southern edge of the school property. The new plant will be constructed immediately to the west of it and use the existing basins for aerobic digestion of solids and existing effluent tanks for treated water storage. Figure 2 shows the existing school, planned expansion and existing WWTP and 350-foot setback required. With noise/odor/aesthetic controls, the setback may be reduced to 50 feet. No 100-year floodplain boundaries are located on the school property. Figure 2B shows an aerial photo view of the existing school.

In accordance with the current Arizona Administrative Code, the setback requirements for the school expansion are provided in Table 4-3.

Table 4-3
Minimum WWTP Setback Requirements (AAC R18-9-B201)

Flow Range (gpd)	Setback with No Controls (ft)	Setback with Full Aesthetic, Noise & Odor Control (ft)
3000 to less than 24,000	250	25
24,000 to less than 100,000	350	50

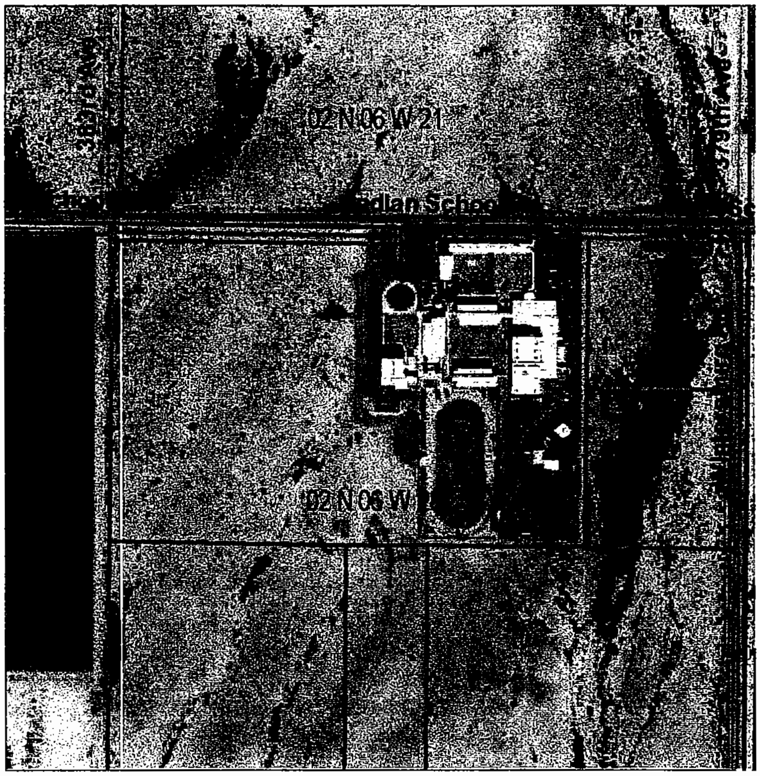

Figure 2B – Aerial Photo of Existing School

The setback distances are measured from the process components. They are intended to be good neighbor criteria and MCESD has indicated only non-occupied buildings will be allowed within the setback. No controls means that the facility is not equipped with any means to mitigate noise and odor potentials. Aesthetic control is typically referred to as fencing and landscaping to blend in with the local environment. Noise and odor controls require equipment to suppress noise potential and scrub foul air prior to either affecting the surrounding neighbors. Enclosures typically refer to a building around the treatment plant or covers on each unit process.

Setbacks require waivers from affected property owners. The property owner acknowledges awareness of the established setbacks, basic design of the WWTP and the potential for noise and odor in the waiver. Signatures serve as a noise and odor easement provided by the neighboring landowners into perpetuity. The school is obtaining waiver signatures from the adjacent property owners south of the school WWTP.

4.3.2 Site Constraints

The site constraints are limited to the existing school buildings and planned expansion. The space available for above ground recharge basins and sludge drying is limited by the ball fields and buildings planned. Facilities, including recharge basins, must be securely fenced to prevent unauthorized access.

4.4 Effluent Disposition and Requirements

4.4 Effluent Disposition and Requirements

The following sections discuss the possible methods to dispose of the effluent from the wastewater treatment plant. The feasibility of using reuse, recharge, and discharge are discussed.

4.4.1 Reuse

Wastewater reuse is the use of reclaimed wastewater for beneficial purposes without the discharge intermixing with surface waters of the state. It is essentially the use of lower quality water in applications where high quality drinking water is not required. In an Active Management Area (AMA), it also contributes to compliance with the goals for water augmentation and conservation. The expanded school site plan shows approximately 24 acres of ball fields and open space that will likely have turf. The irrigation of the turf and landscaping will use reclaimed effluent as the water supply with the addition of groundwater when the effluent is not adequate for the landscape water requirements.

4.4.2 Recharge

Recharge is the act of placing water into an aquifer for storage or augmentation. The water supply considered for recharge at the school is reclaimed effluent. Recharge will help meet storage requirements of a reuse permit. This report identifies possible sites, and viable methods for recharge of reclaimed effluent.

The sites consist of areas on-site that are open space for recharge basins or underground infiltration chambers. The areas reviewed for this report are west of the treatment plant location. The possible locations are shown in Figure 2.

Two methods are considered based on lithologic data near the area. The two methods are surface rapid infiltration basins and subsurface trenches or vaults to accomplish subsurface infiltration. For a surface rapid infiltration basin, the preliminary estimate of required area is approximately 0.51 acres for the volume of 55,000 gallons per day.

Estimated infiltration area required = 55,000 gpd /7.481 gal/cf =
  7,352 cf/day (12 in/ft) /43,560 sf/acre = 2.02 in-ac/day/ 6 in/day =
  0.34 acres = 14,700 sf
Additional Area for berms and access: 7350 sf
Total Area for one basin: 22,050 sf = 0.51
Total Area for two basins: 44,100 sf = 1.01 acres

This assumes an infiltration rate of 6 inches per day. **Pilot testing is required** to verify this assumption. Two basins are required for redundancy and maintenance. The total area required for the recharge basins, based on a seepage rate of 6 inches per day, is 1.13 acres or 44,100 square feet.

The other option, subsurface chambers in trenches, would be installed a few feet below grade. Assuming a seepage rate of 6 inches per day and a total seepage area required of 14,700 sf, the area required for chambers is estimated to be approximately 0.57 acres or 24,600 sf. This assumes 33 square feet per chamber, for a 7.5 ft long x 2.83 ft wide chamber. A total of 450 chambers are required. With the maximum trench length of 100 feet, the number of trenches required is 28. With 100% redundancy, the total area required for the chambers is 1.13 acres. The surface above the chambers may be used as open space or ball fields.

The cost to install recharge basins and chambers were compared as Shown in Table 4-4, assuming an infiltration rate of 6 inches per day.

Table 4-4
Infiltration Recharge Options Cost Estimate Comparison

Description	Estimated Cost
Recharge Basins, 0.66 acres	$ 55,000
Infiltration Chambers, 1 acre, 2,190 linear feet of chambers	$ 78,000

Despite the higher cost, Fluid Solutions recommends installing infiltration chambers for recharge. The chambers will not use any of the playground/open space area and will be out of sight. In addition, there will not be any security issues.

4.4.3 Discharge

Surface discharge is the direct disposal of treated wastewater to a surface water stream with designated water quality requirements. In the evaluation of alternative effluent disposal options, there are no major canals near the school for possible discharge. Discharge was not considered for effluent disposal.

4.4.4 Summary

Effluent disposal for the school will be reuse and recharge of excess effluent. Water balance criteria to balance varying reuse demands against available effluent flows shall consider storage and recharge facilities. This use shall be limited to areas that do not require potable quality water such as turf irrigation, thereby preserving the available quantities of potable quality water for human consumption. The excess effluent will be recharged in infiltration chambers below grade and out of sight of the students and staff.

5.0 REGULATORY REQUIREMENTS

5.1 Regulations

Regulatory requirements apply to water and wastewater systems of every community that provides these services to their residents. The regulatory requirements are intended to contribute guidance to the providers of these services in an effort to protect the environment in addition to human health and safety. These regulations are derived from the federal Clean Water and Safe Drinking Water Acts.

Regulations for the use of effluent in Arizona cross federal program boundaries and tie together both of these Acts due to the arid nature of the southwestern United States. The State of Arizona provides the governing agencies that regulate these activities through the Arizona Department of Environmental Quality (ADEQ) and the Arizona Department of Water Resources (ADWR). ADEQ is predominantly concerned with the regulations that meet the requirements of the federal acts. These programs are designed to ensure that the quality of water is suitable for the end use. ADWR is predominantly concerned with protecting the public from damage, financial or otherwise. They regulate water supplies, rights of use, and disposition activities that could affect others. These agencies work together to protect the health and welfare of the public through protecting surface and subsurface waters for their intended uses without causing damage to others by that use. This effort is achieved through permits. These permits serve as a regulatory tool used to enforce protection of the public and the environment. Permits that may apply to reclaimed effluent uses and dispositions include the following:

- Aquifer Protection Permit (APP) and Reuse Permit. Administered by ADEQ for ensuring that the quality of the aquifer is protected from activities that could cause degradation in accordance with the federal acts. Required of all wastewater treatment in Arizona. An individual permit is required for plants larger than 24,000 gpd.

- Underground Storage Facility (USF) Permit. Administered by ADWR for ensuring that the facility used to recharge reclaimed effluent is constructed and operated in a manner that will not damage others, either financially or physically. Required if groundwater credits are sought to augment potable water supplies.

- Water Storage Permit. Administered by ADWR for water accounting purposes so that the volumes stored may be credited or recovered by the permitted recharger or designated beneficiary. Required if USF Permit is obtained to provide water accounting.

- Recovery Well Permit. Administered by ADWR for recovery of stored water. It serves as the debit side of the water accounting sheet. Required to recover stored water when Assured Water Supply Certification uses this method of attainment as a condition.

- National Pollution Discharge Elimination System (NPDES) Permit. Administered by ADEQ for the United States Environmental Protection Agency (USEPA) for protection of designated surface waters and their tributaries. Required for all discharges to surface waters, tributary washes, and canals.

5.2 Aquifer Protection Permit

The APP program was adopted in 1989 to replace the Groundwater Quality Protection Permit. The permit was established to fulfill the requirements of the Environmental Quality Act adopted by legislation into Title 49 of the Arizona Revised Statutes. Reuse and plan review and approval were combined with the APP program in 2001 under the unified permitting program. The program is intended to assure treated effluent and solids do not contribute to the degradation of aquifer water quality. It provides the State with the ability to control minimum standards for wastewater treatment for all permits issued within the state.

In general terms, the APP requires that the applicant make two demonstrations intended to assure that the aquifers of the state are protected from contamination. The first demonstration must show that the WWTP and/or recharge/reuse facility is designed, constructed, and operated to achieve the greatest degree of discharge pollutant reduction. For the treatment plant this is achieved through the application of the best available demonstrated control technology (BADCT) processes, operating methods, and other acceptable alternatives. The objective of BADCT is to reduce the pollutant load on the state's aquifers as much as technically possible. This requires the selection of optimal technologies for wastewater treatment to assure the most effective discharge controls for the conditions. The result of the selected BADCT must not violate Aquifer Water Quality Standards (AWQS) at the location where the effluent first meets with the aquifer. In the case of consumptive reuse, BADCT is met through consumption of the effluent precluding it from ever reaching the aquifer.

The second demonstration must show that the discharge will not cause or contribute to a violation of an AWQS at the point of compliance. The point of compliance is the location where the effluent first meets with the aquifer. If an AWQS has been previously violated by other causes, the discharge must not contribute to any further degradation. In cases where the aquifer has previously been degraded by other causes, this second demonstration can be met if the discharge to the aquifer will begin to reclaim the aquifer water quality. In some cases ADEQ may relax the AWQS if a benefit to the aquifer can be realized; however, the standard may be required at a later date as the aquifer recovers. AWQS relaxation is only temporary and the treatment works must be able to meet AWQS at a future date.

The Ruth Fisher School WWTP previously fell under the General APP for facilities with less than 24,000 gpd. The state rules require an individual APP for the new wastewater treatment plant.

Table 5-1
Numeric Aquifer Water Quality Standards

Standards for Inorganic Chemicals

Pollutant	Concentration Limit (milligrams per liter [mg/l])	Pollutant	Concentration Limit (mg/l)
Antimony	0.006	Lead	0.05
Arsenic[1]	0.05	Mercury	0.002
Asbestos	7 million fibers/liter (longer than 10 μm)	Nickel	0.1
Barium	2.0	Nitrate (as N)	10
Beryllium	0.004	Nitrite (as N)	1
Cadmium	0.005	Total Nitrate and Nitrite (as N)	10
Chromium	0.1	Selenium	0.05
Cyanide (as Free Cyanide)	0.2	Thallium	0.002
Fluoride	4.0		

(2) Arsenic new standard is 10 ug/l (0.010 mg/l) effective January 2006 and may affect future APP requirements.

Standards for Organic Chemicals

Pollutant	Concentration Limit (mg/l)	Pollutant	Concentration Limit (mg/l)
Benzene	0.005	Hexachlorocyclopentadiene	0.05
Benzo (A) pyrene	0.0002	Monochlorobenzene	0.1
Carbon Tetrachloride	0.005	Pentachlorophenol	0.001
o-Dichlorobenzene	0.6	Styrene	0.1
para-Dichlorobenzene	0.075	2,3,7,8-TCDD (Dioxin)	0.00000003
1,2-Dichloroethane	0.005	Tetrachloroethylene	0.005
1,1-Dichloroethylene	0.007	Toluene	1.0
cis-1,2-Dichloroetheylene	0.07	Trihalomethanes (Total)	0.08
trans-1,2-Dichloroethylene	0.1	1,2,4-Trichlorobenzene	0.07
1,2-Dichloropropane	0.005	1,1,1-Trichloroethane	0.20
Dichloromethane	0.005	1,1,2-Trichloroethane	0.005
Di (2-ethylhexyl) adipate	0.4	Trichloroethylene	0.005
Di (2-ethylhexyl) pthalate	0.006	Vinyl Chloride	0.002
Ethylbenzene	0.7	Xylenes (Total)	10.0
Hexachlorobenzene	0.001		

Table 5-1
Numeric Aquifer Water Quality Standards (Continued)

Standards for Pesticides and Polychlorinated Biphenyls (PCBs)

Pollutant	Concentration Limit (mg/l)	Pollutant	Concentration Limit (mg/l)
Alachlor	0.002	Glyphosate	0.7
Atrazine	0.003	Heptachlor	0.0004
Carbofuran	0.04	Heptachlor Epoxide	0.0002
Chlordane	0.002	Lindane	0.0002
1,2-Dibromo-3-Chloropropane (DBCP)	0.0002	Methoxychlor	0.04
2,4-Dichlorophenoxyacetic Acid (2,4-D)	0.07	Oxamyl	0.2
Dinoseb	0.007	Picloram	0.5
Diquat	0.02	Polychlorinated Biphenyls (PCBs)	0.0005
Endothall	0.1	Simazine	0.004
Endrin	0.002	Toxaphene	0.003
Ethylene Dibromide (EDB)	0.00005	2,4,5-Trichlorophenoxypropionic Acid (2,4,5-TP or Silvex)	0.05

Standards for Radionuclides

Pollutant	Contaminate Limit (pCi/l)
Gross Alpha (including Radium-226, excluding radon and uranium)	15.0
Combined Radium-226 and Radium-228	5.0
Average Annual Beta Particle	4.0 millirem/year

Standard for Microbiological Contaminants

Pollutant	Contaminate Limit
Total Coliforms	0 per 100 ml

Table 5-1
Numeric Aquifer Water Quality Standards (Continued)

Standards for Turbidity

Turbidity	Contaminate Limit (NTU)
Monthly Average	1
Two Consecutive Day Average	5

5.3 Recharge Permits

5.3.1 Storage Facility Permit

The storage facility permit regulates the operations of a site used to store, save, or replenish water underground. The permits require a plan of operation to ensure that the act of these underground activities will not damage others. Hydrologic reports that describe existing aquifer conditions and how the act of storage will affect aquifer conditions supplement this plan. There are two types of storage facility permits—a Groundwater Savings Facility Permit, and a USF Permit.

The Groundwater Savings Facility Permit is required when in-lieu water credits are accumulated for use at a later date. This applies when an alternative supply of water is delivered to an existing groundwater use. An example would be the use of reclaimed effluent on a golf course that currently exists and has been using groundwater. When this turf facility successfully switches over to complete use of effluent, groundwater is saved and can be credited for future withdrawal by the permit holder. In this case, actual recharge is not occurring, but the permit facilitates accumulation of credits because effluent is used in lieu of groundwater. Groundwater remains in the aquifer as a result of these activities.

The USF Permit is used for a facility that is actually recharging a source of water to the aquifer in a constructed facility. These facilities can be rapid infiltration basins, injection wells, or other alternative systems. Credits are accumulated based on the actual volumes of water that are recharged to the groundwater. In cases where this occurs in a naturally transmissive area, such as a streambed without constructed facilities, a managed Underground Storage Facility Permit is required. Credits for these facilities are based on a percentage of the water that recharges to the groundwater.

These permits will only be issued to facilities located in areas where it can be proven that other nearby land or water users will not be harmed by the recharge activities. This determination is made through examination of an area of impact similar to that required under APP requirements.

No recharge permits will be sought at this time since the school district does not have a need for groundwater recharge credits.

5.3.2 Water Storage Permit

A Water Storage Permit is used to establish volumetric limits to the storage capacity. This permit identifies the amount of water for which storage credits may be accumulated at a specific facility. The purpose of this is founded in ensuring that others in the area do not experience property or water-related damages resulting from the storage activities. These permits serve as the checking accounts for all recharge facilities. No water storage permit will be sought at this time since the school district does not have a need for groundwater recharge credits.

5.3.3 Recovery Well Permit

Once a facility has been established and storage credits are being accumulated, recovery of the water supply is monitored and controlled. Recovery Well Permits identify wells from which stored water can be recovered, and in what volumes that recovery may occur. No recovery well permit will be sought at this time since the school district does not have a need for groundwater recharge credits.

5.4 Wastewater Reuse

Wastewater reuse is the use of reclaimed wastewater for beneficial purposes as allowed by the Arizona Administrative Code. Reclaimed wastewater is defined under the state rules as "water that has been treated or processed by a WWTP or an onsite wastewater treatment facility." Reuse can be a beneficial use only, or it can provide additional treatment to the effluent. Irrigation of vegetation using treated wastewater is the most common use of reclaimed wastewater. The school plans to reuse as much of the effluent as is available according to the water needs of the turf and landscaping.

5.4.1 Reuse Regulations

Depending on the effluent quality, volume, and method of reuse, the use will fall under a Type 1, 2, or 3 General or Individual Aquifer Protection Permit. Table 5-3 below outlines the types of permits. The Class of effluent will be determined by ADEQ from the APP application. The APP will list the effluent class, reuse monitoring and reporting requirements, and storage and disposal provisions when the effluent cannot be reused.

Table 5-3
Types of Reuse Permits

Permit	Notification to ADEQ Required?	Permit Fee	Verification of General Permit Conformance from ADEQ	Permit Term
General Permit				
Type 1	No	No	No	Unlimited
Type 2	Yes	Yes	No	5 years
Type 3	Yes	Yes	Yes	5 years
Individual Permit	Yes	Yes	Review, draft, public notice, etc.	5 years

Type 1 permits are for gray water reuse at an individual residence. Type 2 permits are used for direct reuse of Classes A+, A, B+, B, and C effluent following the General Permit requirements for less than 24,000 gpd flow. Type 3 permits are used for Water Blending Facilities, Reclaimed Water Agents, and gray water reuse. The school WWTP will fall under the Individual Permit with a flow larger than 24,000 gpd.

For each class, treatment criteria are streamlined to include fecal coliform, nitrogen and turbidity criteria for the effluent for the reuse application. Table 4-4 lists the classes of reclaimed water. If an alternative secondary treatment method is used, other than biological treatment, the effluent must meet an additional criterion for direct reuse for Class A+ or A. The additional criterion is that there will be no detectable enteric virus in 4 of the last 7 samples. For the school, this will not apply if the secondary process will be a microbiological treatment process.

Table 5-4
Reuse Effluent Quality Categories

Class	Disinfection (MPN/100ml)	Turbidity (NTU)	Nitrogen (mg/l)	Treatment Process
A+	Fecal Coliform = 0 (7 sample median) and < 23 (single sample max)	≤ 2 (24 hr ave.) never > 5	Total N ≤ 10 (5 mo. Rolling geo. Mean)	Secondary Treatment and Nitrogen Removal, Filtration (use of Coagulants/polymer if needed to meet turbidity), Disinfection
A	Fecal Coliform = 0 (7 sample median) and < 23 (single sample max)	≤ 2 (24 hr ave.) never > 5	N/A	Secondary Treatment, Filtration (use of Coagulants/polymer if needed to meet turbidity), Disinfection
B+	Fecal Coliform < 126 (7 sample median) and < 576 (single sample max)	N/A	Total N ≤ 10 (5 mo. Rolling geo. Mean)	Secondary Treatment, Nitrogen Removal, Disinfection
B	Fecal Coliform < 126 (7 sample median) and < 576 (single sample max)	N/A	N/A	Secondary Treatment, Disinfection
C	Fecal Coliform < 1000 (7 sample median) and <4000 (single sample max)	Meet requirements of 40 CFR Part 113 of Code of Federal Regulations		Secondary Treatment by Lagoon Stabilization for at least 30 days

Note: Secondary Treatment is defined as biological treatment meeting the requirements of 40 CFR 133.102: BOD_5 <30 mg/l (30 day average); TSS < 30 mg/l and 85% removal (30 day average); pH 6.0-9.0.

Acronyms: MPN – Most Probable Number of colony forming units per 100 milliliters (ml) of effluent; NTU – Nephelometric Turbidity Units

Under the Aquifer Protection rules Classes A+ and B+ do not require impoundment lining of effluent storage because the total nitrogen (including nitrate) level of these effluent classes has been lowered below the aquifer water quality standard. Other classes require the storage to be lined because Nitrate is not retained in soil and can leach into the groundwater causing degradation of the quality. Classes A, B, and C also require a water balance or other method to make the direct reuse consumptive so that nitrate does not reach the groundwater. A water balance may be required for all uses to ensure that sufficient disposal mechanisms exist for all effluent produced.

The primary consideration for reclamation systems is that the quality of the reclaimed water is appropriate for its intended use, without contributing to the degradation of any potential receiving water. To meet this goal, the classes of effluent have limits on which applications they can be used for as shown in Table 5-5. The highest quality water, Class A+, can be used for all listed reuse applications.

Table 5-5
Minimum Reclaimed Water Quality Requirements
for Direct Reuse Applications

Type of Direct Reuse Application	Minimum Class of Reclaimed Water Required
Irrigation of Food Crops	A
Recreational and other open access impoundment of effluent	A
Residential Landscape irrigation	A
School ground landscape irrigation	A
Other open access landscape irrigation (e.g., parks, cemeteries, greenbelts, common areas).	A
Toilet and urinal flushing	A
Fire protection systems	A
Commercial nurseries	A
Spray irrigation of an orchard or vineyard	A
Commercial air conditioning systems	A
Vehicle and equipment washing	A
Surface irrigation of an orchard or vineyard	B
Golf course irrigation	B
Restricted access landscape irrigation (e.g., highway medians and landscapes and similar areas)	B
Restricted access impoundment	B
Irrigation of food crops for human consumption that will be processed by pasteurizing or sterilizing	B
Dust control	B
Soil compaction and similar construction activities	B
Pasture for milking animals	B
Concrete and cement mixing	B
Materials washing and sieving	B
Street cleaning	B
Pasture for non-milking animals	C
Livestock watering (nondairy animals)	C
Irrigation of sod farms	C
Irrigation of fiber, seed, forage, fodder or similar crops	C
Silviculture	C

School effluent meeting Class A+ may be directly reused to irrigate landscaping on the school grounds. Effluent not used for irrigation will be recharged into the aquifer. In addition, biochemical oxidation demand, total suspended solids, and nitrate removal and low fecal coliform and turbidity will be required for recharge. These standards are required to meet the Aquifer Water Quality standards for nitrogen and minimize plugging the recharge basin soil. Based on these end uses, the effluent will need to meet a Class A+ effluent for the project. This means that secondary treatment with nitrogen removal and filtration will be constructed for the school. As a result, reuse and recharge of the effluent will not be restricted.

5.5 National Pollution Discharge Elimination System (NPDES) Permit

The NPDES permit is issued by ADEQ on behalf of the United States Environmental Protection Agency (EPA) for discharges to waters of the United States. This applies to all navigable waters of the state. The intent of these standards is to provide for protection of public health and welfare. This is done with consideration of surface water use as a public water supply, propagation of fish and wildlife, recreation, irrigation, industrial uses, navigation and other uses. The school will not discharge effluent to a water of the U.S. and is therefore not required to obtain a NPDES permit.

6.0 REUSE

Reuse of reclaimed effluent for any non-potable purpose leaves other high quality water supplies available for potable use through indirect augmentation. Reuse of effluent serves as an acceptable means to dispose of treated wastewater. Successful implementation of this requires that the effluent quantities and methods of use be properly accounted for to protect human health and the environment.

6.1 Design Approach

The type of wastewater reuse possible for Ruth Fisher School is irrigation of ball fields and landscaping. Under current reuse permit guidance, several criteria must be met to allow this use within the community. Initially, the amount of water required to sustain the grass must be determined. This is typically determined for each month of the year so that a water balance may be prepared. The water balance must account for average precipitation and evaporation for each period of analysis in addition to the vegetative demands. The purpose of the water balance is to define the effluent use and storage requirements that will allow the effluent to be consumed on an annualized basis. In many cases this approach allows the treatment and reuse facilities to avoid development of a second disposal method. It also allows the reuse activity to be classified as beneficial augmentation of water supplies.

Storage facilities can take two significantly different approaches and accomplish the same objectives. Above ground storage may be used to store reclaimed effluent during the low demand winter months for use during the high demand summer months. This approach provides more effluent on an annualized basis to irrigate or otherwise beneficially use over a larger area within the community.

The second approach uses groundwater recharge and the aquifer as the storage facility. In this case, unused effluent irrigation is recharged. When reuse applications are not large enough to consume the available reclaimed effluent on an annualized basis, the water contributed to the aquifer will be pumped, having retained its legal character as effluent. Maintaining this legal definition for the water helps avoid conflicts regarding the right to service within an established potable water utility's service area.

6.2 Water Balance

A water balance is a tool that compares the crop area and its water needs against the available water for irrigation. It considers the watering demands; precipitation, irrigation losses, and available irrigation water on a monthly basis to develop annualized system criteria. The results indicate if there is sufficient water, too much water, how much storage is required, and if alternative methods of disposal may be required.

After expansion, Ruth Fisher School will have approximately 24 acres of ball fields and open space that can be irrigated with treated effluent and water treatment blowdown. The water use at the schools is projected to generate more effluent than will be required for irrigation during the winter, but less than the annual requirements for turf. This analysis reviewed irrigation of the ball fields and landscaping for both bermuda grass (summer) and rye grass (winter) on a monthly and an annualized basis. Table 6-1 shows the projected effluent flows, blowdown flow from water treatment added to the effluent, and crop demands. Based on the water balance results, storage or a location to discharge or recharge will be required. During the summer the crops will require water from a second source as well as from the stored effluent to meet the crop demand. A detailed summary of the water demand portion of the water balance is provided in Appendix A of this report. Table 6-1 summarizes the results of this analysis. If only 12 acres of irrigation land are considered, the estimated area of the ball fields only, the analysis shows additional excess effluent during the winter months.

Table 6-1 shows that, on an annualized basis, the development will generate less effluent than required for the turf and landscape irrigation, assuming all acres will have grass turf all year long. On a monthly basis excess effluent will be generated in January, February, April, and October for 24 acres of turf and from October through April for 12.31 acres of turf.

Table 6-1
Water Balance/Effluent Flow Projection Results

Time Period	Estimated Average Water Available (gal/mo)[2]	Area Required for Irrigation of all Effluent (ac)	Estimated Area Available for Irrigation[1] (ac)	Water Required For Irrigation[1] (gal/mo)	Excess Effluent After Irrigation (gal/mo)
January	1,726,452	44.06	24	940,468	785,984
February	1,559,376	24.86		1,516,610	42,766
March	1,726,452	13.93		2,937,911	0
April	1,670,760	49.13		1,311,638	359,124
May	1,726,452	9.13		4,537,773	0
June	835,380	2.95		6,794,439	0
July	60,000	0.18		7,796,496	0
August	863,226	3.27		6,330,071	0
September	1,670,760	9.34		4,293,368	0
October	1,726,452	61.35		1,474,247	252,205
November	1,670,760	21.71		1,847,045	0
December	1,726,452	70.88		584,615	0
Total Annual	16,962,522	61.35 (maximum)		40,364,681	1,440,079
January	1,726,452	44.06	12.31	482,382	1,242,070
February	1,559,376	24.86		777,895	781,481
March	1,726,452	13.93		1,525,369	201,083
April	1,670,760	49.13		672,760	998,000
May	1,726,452	9.13		2,327,499	0
June	835,380	2.95		3,484,981	0
July	60,000	0.18		3,998,953	0
August	863,226	3.27		3,246,799	0
September	1,670,760	9.34		2,202,140	0
October	1,726,452	61.35		756,166	970,286
November	1,670,760	21.71		947,380	723,380
December	1,726,452	70.88		299,859	723,380
Total Annual	16,962,522	61.35 (maximum)		20,719,183	5,639,680

(1) Assuming all 24 acres or 12.31 acres are planted with Bermuda and Rye grass.
(2) Flow Based on Existing Water Use Records with Consideration for School Holidays and Summer Vacation: Effluent plus the Blowdown from the water treatment plant.

6.3 Storage Requirements

Storage will be required to utilize all of the available effluent for irrigation on an annualized basis. Effluent storage is also required for five days in the event of rain if reuse is the method of disposal. Storage could be achieved using two methods. The first is a reservoir that could be an impoundment or a tank. This option is not feasible due to the cost, limited land available and large tank size required during the winter months.

The second solution is a recharge facility that disposes of the effluent underground. This could be accomplished in several ways. To meet just the storage volume required by the mass balance, the facility would need to be capable of accepting a maximum of approximately 25,000 gallons per day for an estimated 60 days during the winter for 24 acres of turf. For 12 acres of turf, the recharge facility would need to be capable of accepting up to 40,000 gpd for five months during the winter. During portions of the winter months the recharge facility would need to be capable of accepting the entire wastewater flow generated (55,000 gallons per day from the WWTP and WTP blowdown) in the event of rainstorms. Based on this analysis, the recharge facility will be sized to accept the entire wastewater flow generated.

6.4 Distribution Requirements

Effluent distribution systems consist of piping and equipment necessary to transfer water to an end use. The system must be capable of meeting the required demands at a reasonable system pressure to achieve the objectives. Installation must maintain the separation requirements between both sewer and water systems to avoid cross contamination.

The school currently has a recharge permit for closed access landscape irrigation. As a result, irrigation activities must occur when facilities are closed or not typically used by the public. After construction of the new WWTP with Class A+ effluent, irrigation will not be restricted. The cost for installing the irrigation system is not included in this analysis because it will be designed and constructed with the landscaping of the school site and ball fields.

7.0 RECHARGE

Recharge of reclaimed effluent is the reuse of this resource through reintroduction into the groundwater supply. It can consist of aquifer storage for future recovery and reuse, aquifer replenishment to reduce or eliminate declining groundwater levels, aquifer water quality improvement through dilution and dispersion of the poor quality water, or an intrusion barrier to stop or mitigate the movement of an undesirable plume of contaminant moving through the aquifer. Groundwater recharge is potentially the most controversial method of effluent use and, at the same time, one of the most viable and potentially beneficial effluent reuse alternatives.

7.1 General Forms of Recharge

Recharge is accomplished in two basic forms: indirect and direct recharge. Indirect recharge occurs where the reclaimed effluent is used for another purpose and recharge to the groundwater is incidental and often unintentional. This can occur due to over irrigation, impoundment percolation, and stream bed percolation when effluent is discharged. Recharge in this manner may provide some benefit to the aquifer, but the community does not realize the full extent of aquifer credit that may be otherwise available. Therefore, indirect recharge is not an attractive method of aquifer recharge in most cases.

Direct recharge is the intentional application of reclaimed effluent into the aquifer through either percolation or an injection system. Percolation is recharge through the vadose zone above the aquifer and is accomplished through two primary methods. The most popular and broadly used is percolation through specially designed and constructed infiltration ponds or subsurface infiltration chambers. Possible recharge basin and infiltration chamber sites are shown in Figure 2. Infiltration basins and chambers require the most land area because infiltration is the slowest form of recharge. The second form of percolation accelerates the percolation rate and reduces the required land area through the use of large diameter dry wells designed and constructed to accommodate large volumes of effluent.

Injection methods further accelerate the recharge rate and reduce the required land area for recharge. Injection also has two primary methods: (1) high rate dry wells constructed to operate under pressure and (2) wells that penetrate directly into the groundwater, called direct injection.

Each of these practices has advantages and disadvantages that must be considered prior to selection of a process. Infiltration ponds must be cycled through wet/dry periods to keep the soil from sealing up as it would in an earthen reservoir. They also have weed maintenance problems that must be kept up with to maintain the desired conditions and appearances. Subsurface chambers do not have the weed problems, also require wet/dry cycles, and may still plug up. They are not visible for inspection other than ports designed into the system. They will require replacement if plugging is significant. Large-diameter dry wells also require wet/dry cycles for the same reasons as infiltration ponds. In the event that these wells plug up, they are difficult to clean. In most cases, the most cost-effective solution may be to make the well larger in diameter. However, at some point, it may require abandonment and replacement with a new well. Pressure dry wells have a tendency to plug in the soil further away from the well screen if not properly cycled through injection pressure ranges, and if the soil is not fully compatible to this type of system. Direct injection into the groundwater typically has problems with well plugging if not designed for reversal of flows and periodic flushing. When properly tested and designed, any of these methods may work very well if the soils are compatible for recharge activities.

7.2 Design Approach

Recharge of any water into the groundwater system is embarking upon a program with unknown conditions and results. This is due to the fact that we can not slice away the earth and obtain an exact picture of the conditions below the ground surface. Additionally, the actual conditions between two potential recharge sites can and probably will be different. Because of the inherent potential problems that could be encountered, all recharge systems should be pursued and evaluated through a phased fatal flaw approach. This approach uses several steps on a small scale to test the viability of a given site for recharge. Local geology is reviewed for compatibility with a given type of recharge. The groundwater is reviewed for existing contaminants that might preclude any future use of the effluent. The recharge method is tested at a pilot scale to determine if it is actually possible and the rate that it may be possible to place the effluent in the ground. If any of these tests fail for a given site, recharge at that site is abandoned before capital dollars are spent to design and construct a full scale facility that may not work up to expected potential. This approach does not guarantee complete success, but it does reduce the potential for partial or complete failure.

7.3 General Geologic Conditions

The school property is located within the Sonoran Desert section of the Basin and Range Physiographic Province. This region is characterized by broad, alluvium-filled, structural basins, separated by sharply rising mountain ranges and scattered low-lying hills formed during the Basin and Range disturbance. Basins are filled with unconsolidated sediments eroded from adjacent mountains.

Sediments consist of weakly to highly consolidated gravel, sand, and some silt at basin margins grading to sand, silt, and clay toward the basin centers, and may include interbedded evaporite deposits and volcanic rocks in places. Subsidence and related internal deposition occurred at different rates; therefore the thickness, areal extent, and grain size of sediments throughout the basin are variable. The percentage of fine-grained material or very fine sand (less than .0625 millimeters in diameter) is about 10 to 50 percent near basin margins, and from 60 to 90 percent in basin centers (Anderson, et al., 1992).

The mountain ranges surrounding the alluvial basins are predominantly metamorphic and igneous, extrusive and granitic rocks of Precambrian to middle Tertiary age. The metamorphic rocks, composed of schist and gneiss, form an impermeable boundary at the basin margins and beneath the basin fill. Extrusive rocks include rhyolite and basalt of middle to late Tertiary age. Most of the extrusive rocks are of minor hydrologic significance, although they may locally contain permeable zones where they are highly vesicular or fractured.

The basin-fill sediments have been separated by name into three or more units by various investigators based on grain size, color, degree of consolidation or deformation, stratigraphic position, clast type, and water-bearing characteristics. There is presently no universally accepted nomenclature for the unit names and their descriptions. For the purposes of this investigation, the hydrogeologic division described by the U.S. Bureau of Reclamation (U.S. Bureau of Reclamation, 1976) will be used. The U.S. Bureau of Reclamation recognized three hydrogeologic units in their evaluation of the geology and groundwater resources of Maricopa and Pinal Counties for the Central Arizona Project. The three units are divided as follows: (1) the upper alluvial unit, (2) the middle fine-grained unit, and (3) the lower conglomerate unit.

For recharge using vadose zone or percolation techniques, our concerns will focus around the upper alluvial unit. This is the only alluvial unit that will have a direct impact on the recharge activities. However, injection methods have the benefit of allowing selection of the alluvial unit that will be directly impacted. General discussions of the three units are provided as follows; however, actual impact of any soil unit that may influence recharge must be investigated at the site of proposed recharge because conditions will vary from these general descriptions.

Successful recharge projects have been developed in similar hydrogeologic settings. On site evaluations are necessary to determine project feasibility and design parameters.

7.4 Alternative Recharge Methods

Consideration of the two types of recharge, infiltration and injection, must both be viewed through the fatal flaw approach to determine if there are any physical limitations at the proposed sites that would preclude either approach from potentially being a viable solution. Through a cursory review of the existing conditions, it appears that there is no reason at this level to eliminate either of the two general types of recharge. Therefore, preliminary costs of both types and several methods will be presented.

Percolation recharge methods that appear viable for this project include rapid infiltration basins, sub-surface infiltration chambers, and dry-well infiltration chambers. Based on mapping of soils performed by the United States Soil Conservation Service (SCS), the soil series in region of Ruth Fisher School include Gunsight, Perryville, Rillito, and Laveen series soils. These consist primarily of loams and gravelly loams. Table 7-1 summarizes select soil characteristics as reported by the SCS.

Table 7-1
Soil Series Characteristics at Ruth Fisher School

Soil Series	Dominant USDA Texture		Unified Class-ification	Permeability (in/hour)	Suitability for:	
	Depth (in)	Texture			Septic Tank Absorption	Pond Reservoirs
Gunsight -Rillito Complex	0-60	Gravelly Loam to Very Gravelly Loam	GC	0.6-2.0	Slight to Moderate	Moderately Slowly Permeable
Perryville	0-38	Gravelly Loam	SM or SC-SM	0.6-2.0	Slight	Moderately Permeable
Rillito-Harqua complex	0-60	Gravelly Loam and Gravelly Sandy Loam	SM or SC-SM	0.6-2.0	Slight	Moderately Permeable
Laveen	0-60	Loam	ML	0.6-2.0	Slight	Moderately Permeable

Rapid infiltration basins consist of basins constructed in a manner that will permit surface spreading of the effluent so that it may percolate through the soil to the groundwater. Sub-surface infiltration chambers consist of long horizontal cells installed just beneath the ground surface in a manner that will permit the effluent volumes to percolate through the soil in much the same manner as rapid infiltration basins. Dry-well chambers consist of large diameter shallow wells that extend from the ground surface to a depth (usually 15 to 50-feet) below the ground surface. These permit percolation in a manner similar to the infiltration chambers, although at a potentially deeper starting elevation.

Injection recharge methods that appear viable for this project include deep injection wells and low pressure dry wells. Deep injection wells consist of wells drilled into a very permeable layer within the groundwater strata. They are designed so that they may be pumped into or out of to facilitate some void-space cleaning. Low pressure dry-wells are similar to the above mentioned dry-well chambers. They may be constructed above groundwater or into groundwater.

Each of these recharge solutions has distinct advantages and disadvantages. Table 7-2 summarizes these issues.

Table 7-2
Advantages and Disadvantages of Recharge Solutions

Alternative	Advantage	Disadvantage
Rapid Infiltration Basins	Ease of maintenance for soil porosity recovery. Operational conditions can be visually observed. Vadose zone redundancy for effluent treatment. Low cost.	Consumes large area, estimated at 0.67 acre. Negative visual impacts as cell dries. Requires landscaping maintenance. Visible to public.
Sub-surface Infiltration Chambers	Not visible to public. Vadose zone redundancy for effluent treatment. ROW, parking area, or open space can be used for land area requirements. Moderate cost.	Operational conditions cannot be visually observed. Requires larger land area, estimated at 1 acre. Not easily maintained for soil porosity recovery.
Dry-well Infiltration Chambers	Moderate maintenance capability for soil porosity recovery. Vadose zone redundancy for effluent treatment. Does not require large landmass. Moderately low cost.	Operational conditions cannot be visually observed. Moderately visible to public. System failure may result in public nuisance issues.
Injection Wells	Appears to be a well. Does not require large landmass. Permits recharge into any chosen alluvial material.	High cost. Operational conditions cannot be visually observed. Not easily maintained for soil porosity recovery.
Low Pressure Dry-wells	Appears to be a well to the public. Does not require large landmass.	Moderately high cost. Operational conditions cannot be visually observed. Not easily maintained for soil porosity recovery

The following table describes the costs of pursuing each of these alternatives assuming that recharge is the sole method of disposal for the estimated 41,150 gallons per day buildout condition. Land costs are not included in this analysis.

Table 7-3
Recharge Systems Estimated Costs for Expansion Flow Conditions

Alternative	Construction Cost	Fatal Flaw & Permitting Cost	Estimated 2003 Capital Cost
Rapid Infiltration Basins(1)	$ 55,000	$ 15,000	$ 70,000
Sub-surface Infiltration Chambers(2)	$ 77,000	$ 20,000	$ 97,000
Dry-well Infiltration Chambers(3)	$ 80,000	$ 85,000	$ 165,000
Injection Wells(4)	$ 1,360,000	$ 250,000	$ 1,610,000
Low Pressure Dry-wells(5)	$200,000	$ 220,000	$ 420,000

(1) Assumes approximately 1-acre of infiltration area at a rate of 6" per day with 100% redundancy.
(2) Assumes chamber has 33 sf of surface area per foot of length. Estimated 900 chambers installed on 1.13 acres of land.
(3) Assumes 2 dry-wells 80 to 100-feet deep.
(4) Assumes 2 wells 500-feet deep with bi-directional flow capabilities.
(5) Assumes 3 dry-wells 80 to 100-feet deep with pressurization and reversal capabilities.
(6) Costs do not include the cost of land.

The Table 7-3 costs do not include the cost to convey the effluent to the site chosen for recharge. Possible sites in the expanded school area include open space near the new WWTP, adjacent to the soccer field on the south, or in the southwest corner as shown in Figure 2. If infiltration chambers do not provide adequate recharge, they may be effectively augmented with dry-wells or recharge basins. Wells will be the most expensive, but will use the least amount of land. The greatest disadvantage to pursuing a well solution is that the actual recharge capacity of each well will not be known until after the well is drilled. This makes estimating the potential cost of this type of solution much less accurate.

7.5 Infiltration Testing

If rapid infiltration basins or an infiltration chamber approach is used, ring infiltrometer or percolation tests will need to be performed at the ground surface in the proposed recharge area. These tests will be an initial attempt to determine if water will actually penetrate the soils and move towards the groundwater in addition to providing preliminary infiltration potential estimates. Tests will be performed in accordance with theory developed by Dr. Herman Bower and used successfully on previous projects to size rapid infiltration basins. Under normal conditions, these infiltrometer tests would be followed by a longer-term pilot scale recharge test using groundwater to determine sustainable recharge capacities per acre. Both infiltrometer and pilot recharge testing are beyond the scope of this report, but should be completed prior to design of any recharge facility.

8.0 DESIGN CRITERIA

8.1 System Objectives

Ruth Fisher School is replacing the existing wastewater treatment plant to allow the expansion of their facilities located in Tonopah. Reclaimed effluent will be used to the fullest extent practicable for irrigation of ball fields and open space landscaping. Excess effluent will be recharged through infiltration chambers. The wastewater treatment plant must be designed and constructed in a manner that would allow for safe and environmentally sound effluent quality for irrigation and recharge.

8.2 Effluent Quality

Based on the beneficial uses of irrigation and recharge, the water quality out of the wastewater treatment plant must be suitable to meet the Aquifer Water Quality Standards shown in Table 4-1 to meet a Class A+ treatment level. This level of treatment will allow the effluent to be discharged into the infiltration chambers, and for irrigation of ball fields and landscaped areas at the school. It will also allow recharge into the aquifer. Specific parameters are shown in Table 8-1.

Table 8-1
Effluent Quality Required

Parameter	Level
BOD_5	10 mg/l
TSS	10 mg/l
Total Nitrogen	≤ 10 mg/l (5 mo. Rolling geo. Mean)
Fecal Coliform	0 (7 sample median) and < 23 (single sample max)
Turbidity	≤ 2 (24 hr ave.) never > 5

8.3 Treatment Plant Phasing

The existing WWTP will be used to treat wastewater until the new plant is complete and operational. The old plant will then be taken out of service and basins to be used will be modified as needed.

8.4 Hydraulics

The hydraulics of the facility define how the liquid will flow through the system. The summary of hydraulic requirements is defined by the wastewater flow rates entering the plant, recycle rates returned within portions of the system, and energy losses of each component and unit process in the system. To avoid flows exceeding process capacities, peak flow is used to determine hydraulic requirements entering the plant. Average flow at peak loading is used to determine the process requirements within the plant. Other considerations that affect hydraulics include velocity, freeboard, and system head. A complete hydraulic design considers each of these components as a system to ensure that wastewater will flow through the facility as intended under predictable conditions.

All facilities experience a daily diurnal and weekly flow pattern that will be relatively consistent with a given season or climatic condition. Diurnal variations reflect the daily water uses within a system that will result in sewer flows. Flows will vary significantly due to these causes throughout the day as students, faculty and staff use facilities as part of their daily routines. Treatment facilities must be capable of handling these variations without spillage or upset.

The impact of peak flow events is a direct function of the area served. In large systems, the impact is relatively small because of sewer length and its ability to absorb peak events within its capacity. This absorption is the result of small local peaks reaching collector and interceptor sewers at different times even if the local events all occur simultaneously. The result is the impact of peaking events on larger pipes is significantly dampened as it approaches the treatment plant due to staggered system peaking. Under these conditions, the peak flow experienced by the treatment plant is much smaller in magnitude than it is in the actual development that participated in generating the flow. Ruth Fisher School is a very small system with very short retention times in the sewers. Therefore, the peak flow event will have a greater impact on the treatment plant.

The peaking analysis for this project does not reflect potential impacts from inflow and infiltration (I & I). The existing collection system and new system was or will be pressure tested upon installation. There are no natural surface water courses through the school site. Therefore, infiltration is not expected to have any significant impact.

Average flows were generated using the water demand data for students based on existing water use data. Based on fixture unit estimates for peak flows, a peak factor will be determined.

8.4.1 Equalization Basin

In an effort to mitigate the direct effects of the daily and hourly peaking events, as well as store the school day flow for treatment over 24 hours, a flow equalization basin will be used. Typically, two types of equalization are used; flow equalization and waste strength equalization. The primary objective of flow equalization is to dampen daily peaks and augment daily lows in the flow conditions and thus achieve a constant or nearly constant flow rate through the plant. Waste strength equalization dampens the variability of the waste by blending the wastewater in the equalization basin. The primary purpose of both types of equalization is to reduce the size of unit processes while improving the ability to reliably treat the wastewater to desired qualities. The equalization basin will be sized to balance school day and evening flow variations and provide some dampening to variations in strength. The sizing will provide detention of two-thirds of the average daily flow. The plant will treat 42,000 gpd or 1,750 gallons per hour. During school hours, this will provide treatment for 14,000 gpd. The remaining two thirds (42,000-14,000 = 28,000 gpd) will be detained and treated throughout the non-school hours.

8.4.2 Velocity

Velocity considerations will vary depending upon the unit process that is under consideration. In areas such as the headworks, velocities should be sufficient to carry solids through for subsequent treatment without allowing deposition or clogging to occur. The exception is headworks facilities designed to remove sands and grit. In these areas, velocities must carry lighter carbonaceous particles to the secondary process while being slow enough to allow heavier particles to be removed from the flow. In secondary basins where the biochemical reactions occur, velocities and related turbulence should be suitable to allow the carbonaceous mass to contact the fixed film for treatment. In clarifying tanks, the velocities should be quiescent enough to allow solid biomass to readily separate from the liquor. In all cases, velocities should be established to be compatible with the unit process and it's physical mechanics on the process being served. Table 8-2 describes typical velocity ranges that could be used through each major unit process of the proposed facility.

Table 8-2
Velocity Range Criteria

Unit Process	Velocity Range (ft/s)	Comment
Preliminary Treatment	1.0 – 3.0	Range between high and low flow
Flow Equalization Basin	NA	Mixing of stored water required
Secondary Reactors	< 0.1	Low Horizontal Velocity with aerated mixing
Secondary Solids Removal	< 0.1	Solids settle and are pumped or air lifted out of basin
Tertiary Filter	NA	Vertical velocity based on filter capabilities
Disinfection	0.1 - 1.0	Range depending on disinfection method

Freeboard must be sufficient to contain flows within the hydraulic structures without spillage due to varying flows. In small structures having vertical walls where the flow through is not impeded, an acceptable freeboard is 1.0 to 1.5 feet.

Head requirements are a direct function of the hydraulics between processes and the unit process conditions. These requirements will vary within each process as flow and solids loading changes. The available head shall include all losses from the process and associated conduits used within the process. It is also prudent to provide excess head in gravity systems to compensate for an unforeseen condition or to accommodate future additional processes if the site gradient will permit.

Due to the topographical conditions at the site, it is likely that the treatment facility will have to be built at a higher elevation than the gravity invert will yield as flows enter the site. This will require pumping into the facility. Hydraulic design through the facility should be compatible to allow gravity flow to recharge infiltration chambers for discharge. Pumping will be required for reuse.

8.5 Preliminary Treatment

Preliminary treatment prepares the raw wastewater for further treatment by removing characteristics that may impede the process or damage equipment. Through preliminary treatment, characteristics of the raw wastewater that are removed include: identifiable debris such as rags, solids, and abrasive grit. Unit processes typically contained in a preliminary treatment system are grinding, equalization, pumping, flow measurement, and screening. Grinding will not be included in this case because the influent gravity flow sewers will have solids removed before the equalization basin and influent pumps.

8.5.1 Screening

Screening of wastewater removes the gross pollutants from the waste stream. This is done to protect downstream processes and equipment. In order to control the potential spreading of disease, some form of control is required by ADEQ to remove floating debris. Screened material will typically consist of rags, sticks, leaves, food particles, bones, plastics, bottle caps, and rocks. Since the screen will be located prior to flow equalization, the equipment must be capable of conveying peak flows into the plant. Table 8-3 summarizes selected screening criteria to treat the flow.

Table 8-3
Screening Criteria

Design Condition	Screening Requirements
Screen Opening	0.25-0.5 inches
Design Hydraulic Capacity	Peak Flow based on fixture units
Maximum Head Loss	1.0 ft at 50 % blind condition
Screened Debris Quantity	10 ft^3 / million gallons

The screening facilities must also have the capabilities of removing biochemical oxygen demanding (BOD) substances and returning them to the influent stream as most landfills in the Southwest will no longer take such materials. Water spray washing of the screenings as they are removed will help remove the BOD from the screenings. Screenings must also be de-watered to permit passage of the paint filter test for landfill acceptance. Draining and compressing of the screenings will de-water them for disposal. Bagging or keeping them inside a closed area will contain them and reduce odors or nuisances.

8.5.2 Equalization

Following the bar screen the wastewater will be stored in the pump station/equalization basin to dampen the peak flows into the facility. The combination equalization basin/influent lift station will have mixing and aeration to prevent stagnation and septic conditions. Engineering Bulletin #11 recommends supplying 1.25 to 2 cubic feet of air per minute per 1000 gallons of storage. The mixing will also help with odors during the periods when school is not in session. The basin will be sized to hold two-thirds of the daily flow. Additional surge capacity will be included in the secondary process described in Section 9.

8.5.3 Influent Pumping

Pumping will be required at Ruth Fisher School to lift gravity sanitary flows into the treatment facility. This system should consist of at least two pumps. One pump must be capable of conveying peak day flow into the treatment plant while lifting average day conditions in a timely manner to minimize odor potential. The second pump serves as backup. The two pumps could be operated in parallel to convey any unforeseeable flow conditions. The pump capacity will be designed for 300 gpm, the peak hour flow, with one pump out of service. For non-school days and low flows a small third pump will be installed with a capacity of 5 gpm. This size is based on the water use records of 10,000 gallons per month (333 gpd average or 1 gpm) during the summer break.

The minimum size for the influent wet well will be sized at 1500 gallons to reduce the cycle time of the pump. From Engineering Bulletin #11:

$$V = cQ/4 = 20(300)/4 = 1500 \text{ gallons}$$

V = volume of wet well
C = cycle time of pump, 20 minutes
Q = pump capacity in gpm

This volume will be incorporated into the 28,000 gallons of equalization storage.

8.5.4 Flow Measurement

Flow measurement is required by ADEQ to monitor the influent volume of the wastewater stream. The method of flow measurement used should be designed to minimize potential problems with grease, grit, and solid materials inherent in the wastewater stream. Measurement of influent flows can be accomplished in an open channel configuration or a pressurized closed conduit configuration. At Ruth Fisher School, flows entering the treatment plant will be screened, equalized, and pumped to the first process component. In this case, flow measurement will be performed in the pressurized discharge from the pumps. The flow measurement method used must be capable of accurate measurement of the volumes delivered under both peak and average flow pumping conditions. Table 8-4 summarizes the criteria for flow measurement at Ruth Fisher School.

Table 8-4
Flow Measurement Criteria

Design Condition	Meter Requirements
Hydraulic Range	300 gpd to 74,000 gpd
Velocity Range	2 to 11 fps
Head Loss at Peak Flow	< 1 inch
Accuracy	2 % of flow

8.5.5 Grit Removal

Grit removal involves the separation of sands, silts and coffee grounds that could settle in control structures or damage process equipment. For a school sewer system, the amount of grit will be minimal.

Grit deposited in the equalization basin will be manually removed.

8.6 Secondary Treatment

The secondary reactors are where the biological processes of the plant take place. This can be a suspended growth, fixed film, or a natural system. In Arizona, most wastewater treatment plants are required to denitrify to meet aquifer protection criteria.

A suspended growth system uses an aerobic process that can achieve relatively high microorganism concentrations with the assistance of recycled biosolids. The environment created in the system should support microorganisms that will convert biodegradable organic constituents and certain inorganic fractions into new cell mass and byproducts that can be separated from the liquid fraction as gas or solids. Gas, typically nitrogen, is released to the atmosphere. Solids are settled out of suspension in a clarifier and removed from the system by physical means. In summary, a suspended growth system is comprised of aeration, solids removal and recycle. Operation can be in a batch or continuous flow mode.

When nitrogen removal is required, the suspended growth system requires multiple stages to create differing environments for the biodegradable matter and nitrogen. The microorganism population that removes nitrogen must have it in a form that will provide an alternative oxygen source. Since most nitrogen enters the treatment plant as ammonia or organic, it must be converted to nitrate and nitrite. This conversion takes place in the aerobic stage where most biodegradable matter is reduced. Sufficient time must be provided for the slow growing microorganisms to use the hydrogen found in ammonia for food to grow. Once they are viable, the hydrogen is consumed and the nitrogen combines with the oxygen provided through aeration. This must then be conveyed to an anoxic stage where mixing is provided but aeration is not. This environment forces a third microorganism population to use the oxygen in nitrate for their required supply. The nitrogen is then released as a gas to the atmosphere. For further details on the Secondary system for the school WWTP, see Section 9.0.

8.7 Tertiary Treatment

Tertiary treatment is the filtration of clarified wastewater. It is required for most reuse applications in urban and suburban areas and for recharge to prevent plugging of the soil. The purpose is to remove the small suspended matter that may carry viruses and pathogens prior to disinfection. It is also used to remove these small particles to improve the effects of ultraviolet (UV) disinfection.

Table 8-5 summarizes the design criteria for filtration to meet the future Class A+ Reclaimed Water for reuse and recharge. The filter will remove BOD, and TSS, and lower the turbidity.

Table 8-5
Tertiary Filter Design Criteria

Design Condition		Criteria
Filtration Area	Average Flow	1.2 gpm/ft^2
	Peak Flow	4.0 gpm/ft^2
Area per Filter (2)		12 ft^2
Sand Size		0.55 to 0.65 mm
TSS removal efficiency		75%
BOD removal efficiency		50%

8.8 Disinfection

Disinfection is required to ensure adequate virus and pathogen removal. Chlorine is the most cost effective and one of the very best disinfectants known to man today. However, since chlorine will react with organic chemicals to form trihalomethanes (THMs), suspected carcinogens, it must be used with a dechlorination system. THMs will be regulated under the APP for groundwater protection. For Ruth Fisher School, the proposed disinfection system is chlorination/dechlorination. Design criteria for chlorination disinfection is shown in Table 8-7.

Table 8-7
Disinfection Design Criteria using Chlorine Tablets

Design Condition	Criteria
Chlorine Dose	6 ppm or 30.15 lb/day for 42,000 gpd
Contact Time	Retention in Existing effluent storage tanks before reuse or recharge; retention in non-potable storage tank before reuse

UV disinfection was also considered for disinfection. It is a physical process where ultraviolet energy is absorbed in the DNA of microorganisms. It causes effective sterilization of the organism preventing future propagation. To ensure that this process is not reversed, after exposure of the microorganisms to the UV light, they must be kept in a dark environment for a period of time to minimize regrowth. In the case of reuse, this can be met in the reuse storage and distribution piping, keeping the effluent out of sunlight until use. Maricopa County recommended that chlorination/dechlorination be used instead of UV disinfection based on the experience of other small treatment plants in the area.

8.9 Biosolids Stabilization and Dewatering

Biosolids consist of the solid fraction of the wastewater flow that is separated from the influent stream through the secondary processes. This material contains organic biomass, nutrients, and metals that are contained in the wastewater. When first removed from the liquid processes, the biosolids are still activated and contain viruses and pathogens that must be stabilized prior to disposal. Typical stabilization processes in use include anaerobic digestion, aerobic digestion, composting, and lime stabilization. Aerobic digestion is very cost effective to construct and operate in facilities under 5.0 mgd. This is the recommendation for Ruth Fisher School WWTP. This process provides an environment that allows aerobic biological reactions to destroy the biologically degradable organic components of sludge. Its function and principles are very similar to the complete mix activated sludge process used for organic reduction and nitrification within the secondary treatment processes.

The process provides direct oxidation of the biodegradable material that was not consumed in the secondary treatment system. Aerobic and facultative microorganisms use oxygen and obtain energy from available organic matter. When properly aerated, microorganisms use energy stored within the cells and eventually the aged cells undergo lysis making themselves available as food for other microorganisms. Finally, as an added benefit that reduces the nitrogen concentration in the supernatant return stream, additional nitrification and denitrification will occur as the biosolid is aerated and settled for decanting in a manner similar to a sequencing batch reactor. Table 8-8 summarizes the design criteria required for aerobic digestion at Ruth Fisher School WWTP.

Table 8-8
Biosolids Stabilization Design Criteria using Aerobic Digestion

Design Condition	Criteria
Solids Retention Time	20 to 30 days
Aeration/Mixing Requirements	20 to 30 scfm/1000 ft^3
Solids Loading	0.1 to 0.2 lb VS/ft^3/day
Dissolved Oxygen	1.5 to 2.5 mg/l

Current EPA regulations require a volatile suspended solids (VSS) reduction of 38 percent in an aerobic digestion process to achieve vector reduction objectives. The measurement of when this has been achieved is the specific oxygen uptake rate (SOUR). When the SOUR of the biosolids is equal to or less than 1 mg of oxygen per hour per gram of total solids, the digestion has achieved vector reduction.

The existing aeration basins will be converted to aerobic digestion for the new plant. Following digestion a bagged biosolids dewatering system will be used. The system will take stabilized biosolids from the digester, add a polymer to enhance agglomeration, and place the mixture into a bag. The bag is constructed to allow liquid to escape out of it but not allow liquid to enter through the bag walls. Once the bags are full, they are stored on a pallet until transported as a dry solid to a landfill or other acceptable use. In some cases, if retained on site long enough, the biosolid may meet a Class A biosolid as defined by the Federal 503 Regulations and be suitable for reuse as fertilizer. The limited space at the plant site limits the amount of solids stored at the site.

8.10 Odor Control and Ventilation

Odor control and ventilation will be required for the protection of the operations staff from hazardous gasses in confined spaces. The hazardous gasses must be kept within the requirements of the Occupational Safety and Health Administration's (OSHA) confined space rule. Primary gasses of concern include hydrogen sulfide (smells like rotten eggs) and ammonia (smells antiseptic). The influent wet well/equalization basin, aeration basins, bar screen, and other processes will be open to the atmosphere for venting.

8.11 Administrative and Laboratory Facilities

Administrative and laboratory facilities will be provided in the existing maintenance areas of the school facility.

8,12 Back-up Power Generation

ADEQ Bulletin #11 requires back-up power for processes that are critical to plant operation. Connection for a mobile diesel generator will be provided as back-up in the event of a power failure. The mechanical equipment that requires back-up power includes:

Influent Pumps | Mechanical Screen | Aeration

Internal Recycle and Solids Recycle in Conventional Activated Sludge system

8.13 Site Constraints

The site chosen for the treatment facility is limited in size. As a result, the design will minimize the footprint of the plant. A preliminary site layout is shown in Figure 3.

9.0 SECONDARY SYSTEM PROCESS DESCRIPTION

The secondary system of a wastewater treatment plant contains the biological process of the plant where the most operational flexibility is required. The flexibility built into this part of the system directly affects the ability to meet treatment requirements through variations in influent quality. This system is comprised of components consisting of the reactor basins, solids separation, and recycle systems. When removal of nutrients such as nitrogen is required, the reactor basin component may be divided into multiple stages that allow different environments for survival of the required microorganisms. These stages are differentiated by the quantities of dissolved oxygen maintained to develop the environments required to support the desired microorganism populations.

This study reviewed four package plants that provide secondary treatment including nitrification and denitrification. All processes are capable of treating the wastewater to the required levels for open access reuse and recharge on the project. The assumed influent wastewater characteristics are shown in Table 9-1.

Table 9-1
Assumed Influent Wastewater Characteristics

Parameter	Unit	Total
Average flow	gpd	42,000
	gpm	85
Peaking factor(1)		15
Peak flow	gpm	438
TSS	mg/L	300
VSS(2)	mg/L	188
BOD concentration	mg/L	250
BOD load	lbs/d	156.5
TOC	mg/L	220
Total nitrogen	mg/L	40
Ammonia	mg/L	25
Organic nitrogen	mg/l	15
Alkalinity	mg/L	180
Peak Equalized flow for solids separation(3)	gpm	130
Equalized flow (for Secondary Process)	gpm	22

(1) As described in Section 3.1 of this report.
(2) Assumed at 75% of TSS.
(3) Sized for a hydraulic loading of $2Q_A$ after equalization to ensure continuous efficient operation.

9.1 Complete Mix Activated Sludge

By definition, the complete mix activated sludge (CMAS) system has uniform characteristics throughout the contents of the entire reactor or reactor stage. Because it is a complete mix system and the characteristics are considered uniform throughout

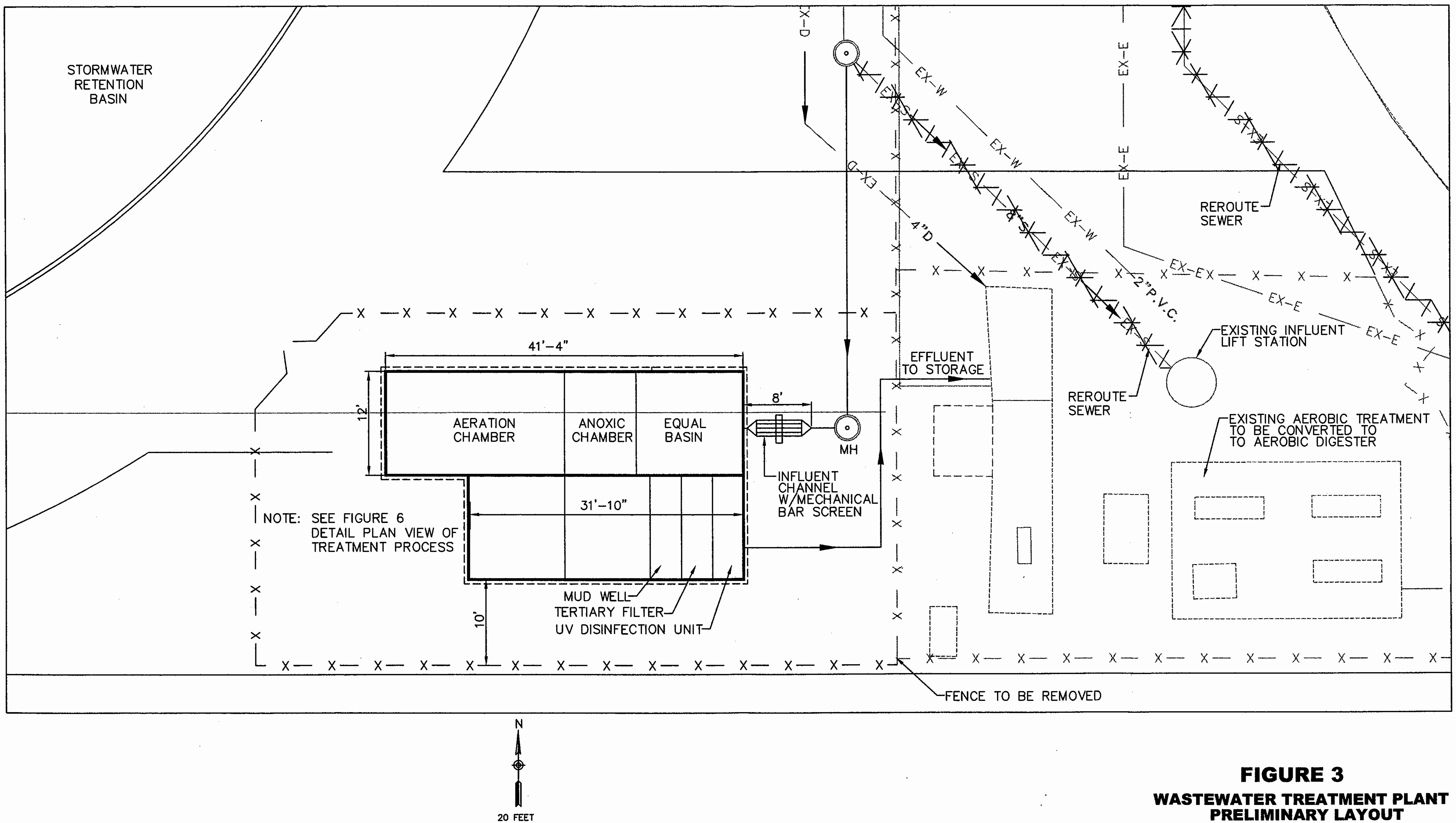

FIGURE 3

WASTEWATER TREATMENT PLANT PRELIMINARY LAYOUT

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the reactor, it is very resilient to surges in organic loading without significant change in effluent quality. It is also capable of operating on limited food supply for the microorganisms. The reactors can be square, round, or rectangular. Their shape and depth are somewhat controlled by the mixing and aeration equipment chosen to maintain the complete mix and oxygen supplies.

Three conventional package plant CMAS systems were reviewed for this project. The lowest cost was for the steel tanks and equipment supplied by Ashbrook Corporation. Ashbrook produces a conventional activated sludge package treatment plant which includes a rectangular anoxic zone with a continuous mixer providing denitrification and a rectangular aerobic zone with air diffusers providing oxygen and air for mixing, nitrification and reduction of BOD. Recycle from the aerated zone to the anoxic zone with adjustment from 200 to 400% of flow is provided by a recycle pump.

A circular clarifier follows the treatment zones to allow the sludge to settle to the bottom. The sludge is recycled back into the aerobic zone. The activated sludge, extended air process used, with anoxic and aerobic zones, is conventional. The preliminary plant layout is shown in Figure 3. The process flow diagram is shown in Figure 5, detailed preliminary plans in Figures 6 and 7 and the cut sheets are included in Appendix C.

9.2 Estimated Costs

These costs represent the probable costs for actual construction of the unit processes on the site in 2004 dollars. For the Ashbrook Corporation system, the costs are based on a flow of 42,000 gpd at build out.

Costs not included in the cost estimates shown below include the collection system, electrical service to the site, effluent pumping to the landscape irrigation system and treatment plant site landscaping, and effluent recharge facilities.

The estimated capital costs to construct this facility are provided in Table 9-3.

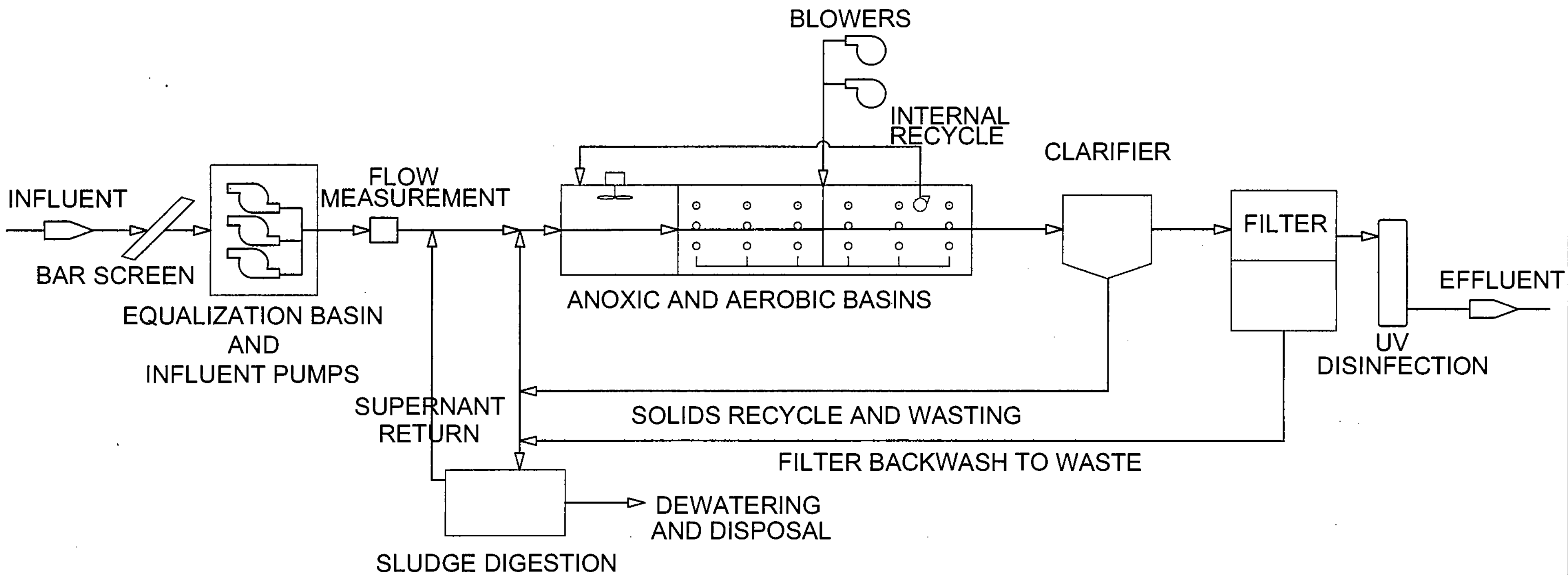

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FIGURE 5 ASHBROOK PROCESS FLOW DIAGRAM

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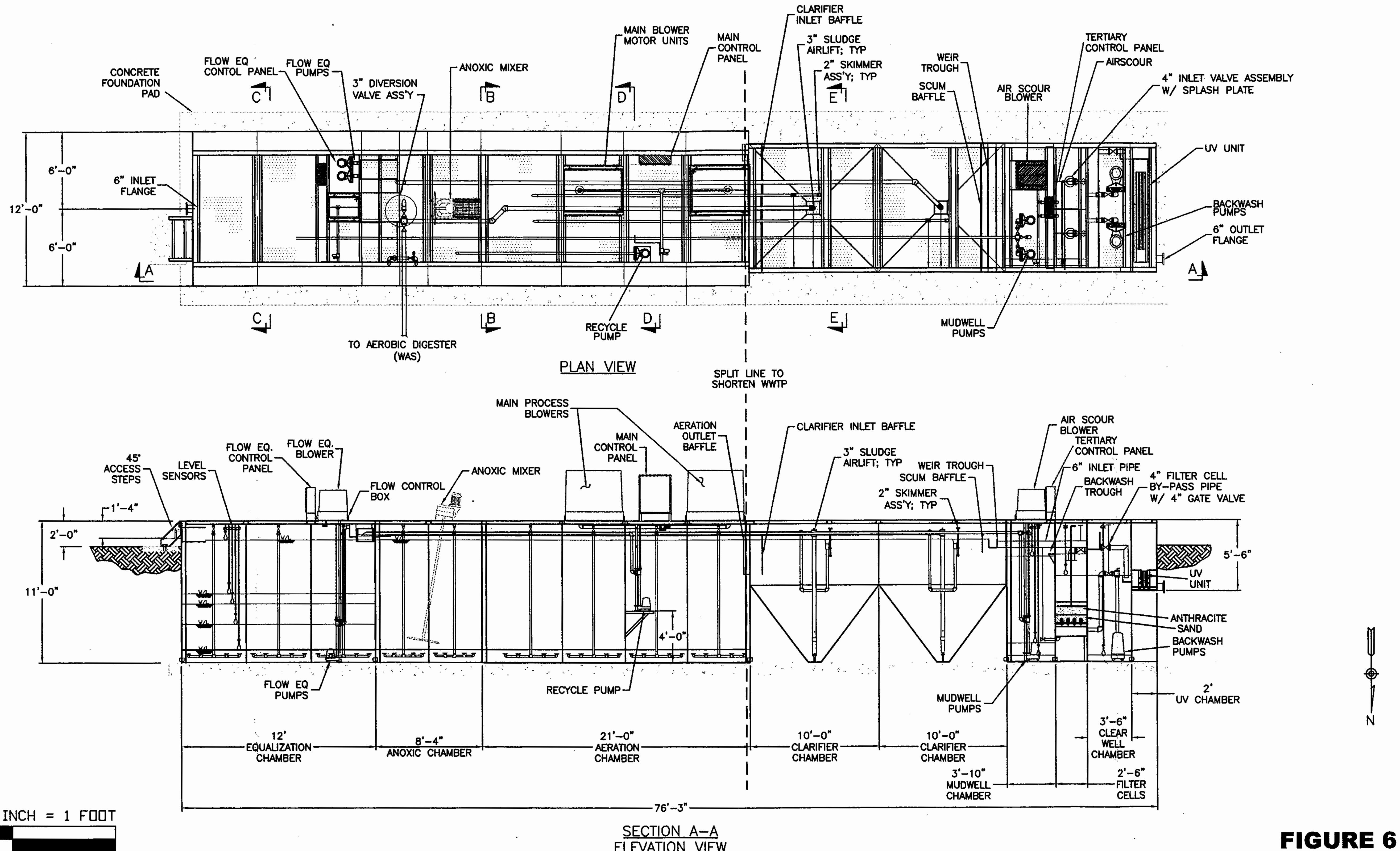

NOTE: SEE FIGURE 7 FOR SECTION VIEW

FIGURE 6
ASHBROOK SYSTEM

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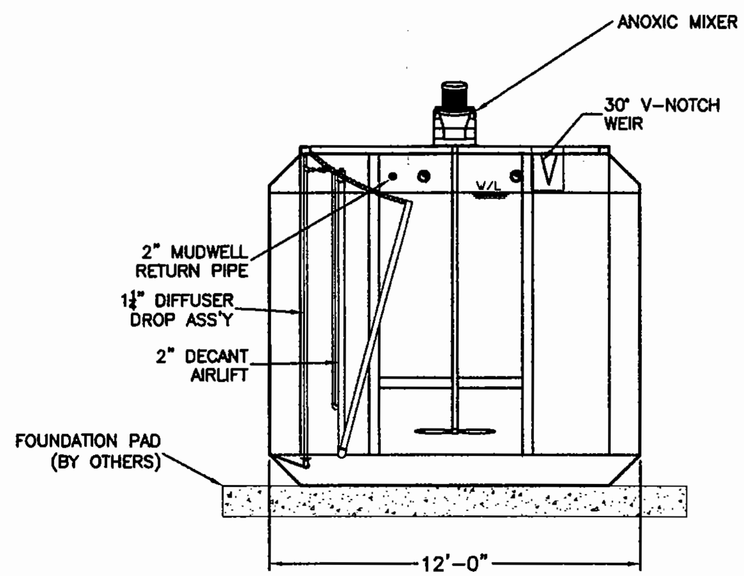
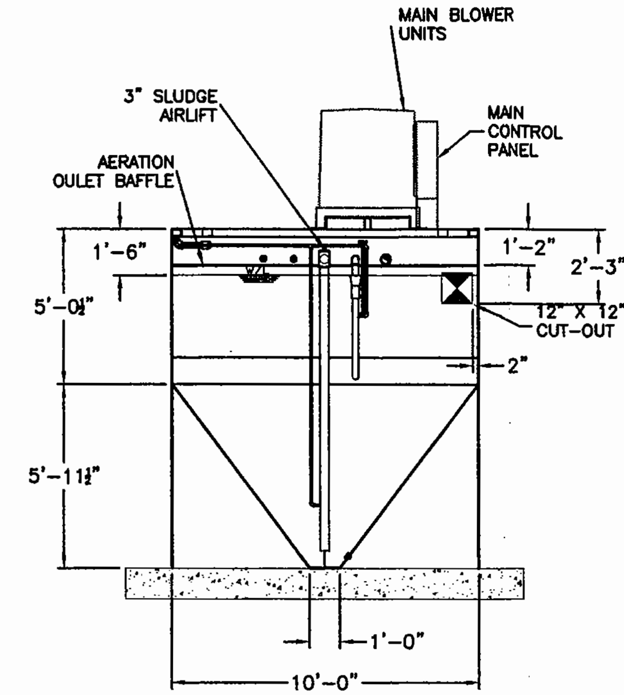


SECTION "B-B"
ANOXIC CHAMBER



SECTION "E-E"
CLARIFIER CHAMBER

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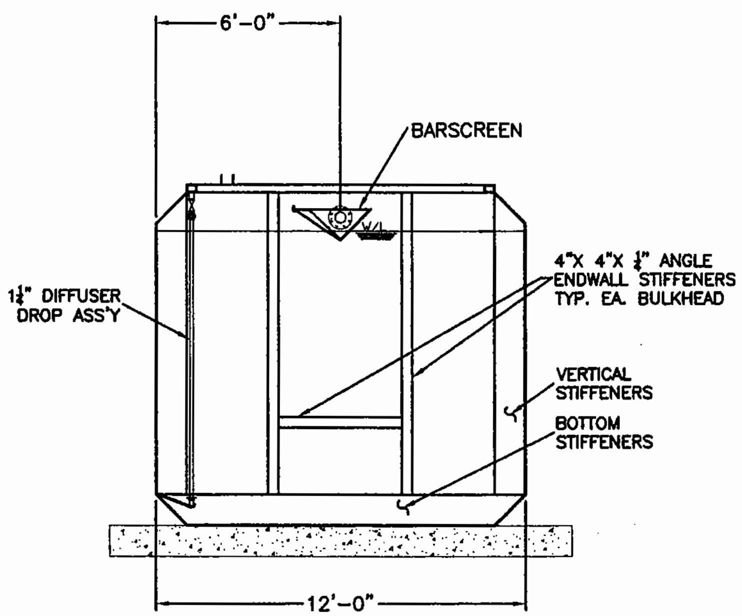
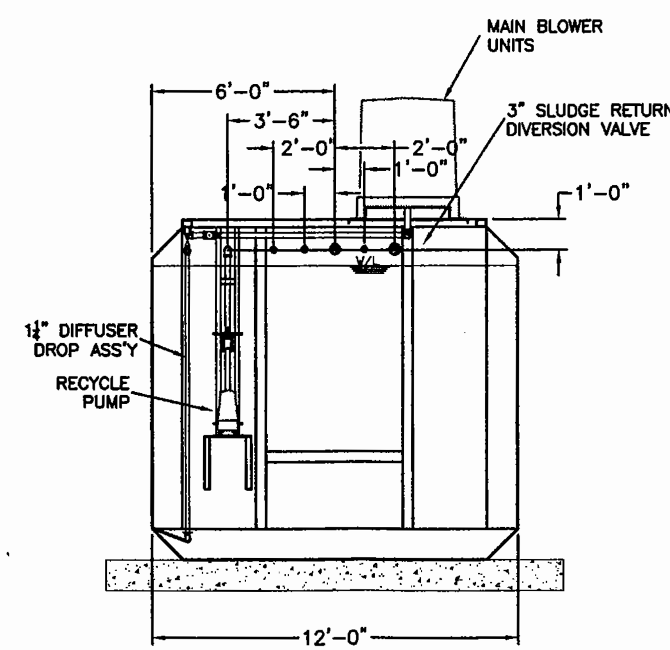
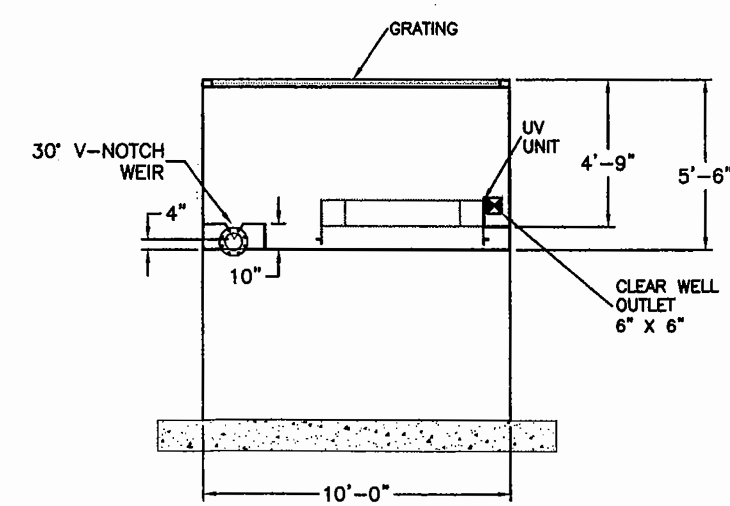
N.T.S.



SECTION "C-C"
EQUALIZATION CHAMBER



SECTION "D-D"
AERATION CHAMBER



SECTION "F-F"
DISINFECTION

NOTE: SEE FIGURE 6 FOR PLAN VIEW

FIGURE 7

ASHBROOK SECTIONS OF SECONDARY TREATMENT

Fluid Solutions
Water, Wastewater, Engineering & Environmental Services
1121 EAST MISSOURI AVENUE ▪ SUITE 100 ▪ PHOENIX, ARIZONA 85014

RUTH FISHER SCHOOL
WASTE WATER TREATMENT
DESIGN CONCEPT REPORT

S:/CLIENTS/RUTH FISHER SCHOOL/SCHOOL OVERVIEW/SECONDARY TREATMENT/FIG.-7.dwg. 3/23/04

Table 9-3
Ashbrook Preliminary Estimate of Probable Capital Costs[1]

Unit Process System	Ashbrook System Estimated Costs
Ashbrook Package Plant Includes: 28,000 gallon equalization chamber, duplex ½horsepower pumps, equalization blower, 7,000 gallon Anoxic Chamber, 2 HP mixer, 17,500 gallon Aeration Chamber, Main blowers and controls, Sludge tank, Airlift pumps for supernatant, sludge, and scum, Clarifiers, handrail, stairway, coating, filters and controls, and polymer feed system.	$193,000
Site Work	$4,875
Ex. Pipe rerouted into New Plant	$12,960
Flowmeter	$3,450
Mechanical Bar Screen and Channel	$55,400
Influent Pumps	$12,000
Concrete Slab	$24,750
Effluent Piping to Tank	$1,150
Modifications to Ex. Plant for Digester	$1,750
Sludge Piping to Digester	$1,280
Sludge Bag System	$28,000
Electrical to New Equipment	$50,061
Tablet Chlorination/Dechlorination	$2,000
Cathodic Protection	$33,374
Subtotal	$424,050
Taxes, Bonds, Insurance (@ 15%)	$63,608
Contingency (@10%)	$42,405
Estimated Capital Cost (Rounded)	$530,063

(1) Costs are shown in 2004 dollars.
(1) Costs from Ashbrook include electrical and controls for the secondary processes.

The cost per gallon for the wastewater treatment plant is $12.62. This cost assumes the buildout flow will be 42,000 gpd.

9.3 Comparison of Manufacturers

Three conventional activated sludge package plants and the Ionics MBR system were compared based on size and estimated costs. All would be capable, when properly designed, installed and operated, of meeting the effluent water quality requirements for Ruth Fisher School WWTP. From a total capital cost standpoint, the Ashbrook Corporation system, with its steel tanks, was the best alternative.

10.0 Summary and Recommendations

In summary, the new Ruth Fisher School WWTP will be designed to treat a flow of 42,000 gpd and produce a Class A+ effluent suitable for landscape and ball field irrigation reuse and recharge to groundwater under current rules and regulations. It is arguable that a Class B effluent could be used on the ball fields in a similar manner to a golf course where access can be restricted during irrigation practices. However, the school has children that may be on the grounds while still wet and the case for restricted access will not be accepted by Maricopa County. Refer to Table 5-5 for acceptable uses of different classes of effluent. A+ effluent is filtered to remove, to the greatest extent possible, the biomass that could convey viruses and pathogens. It is also denitrified which will allow blending with the water system waste stream while not exceeding ambient groundwater conditions under a recharge scenario.

The treatment process recommended is preliminary screening and equalization with an influent pump station to a nitrification-denitrification activated sludge package plant with chlorination/dechlorination. The sludge will be recycled or wasted for digestion, settling, and dewatering by the bagging system, and on-site drying for landfill disposal.

Effluent will be combined with the blowdown from the groundwater treatment plant and reused for landscape irrigation. The excess effluent and blowdown will be recharged through subsurface infiltration chambers.

Appendix A
Water Balance Calculations

Ruth Fisher School

KLH 10/6/03

Wastewater Flow Calculations

Phase	Students	Unit Demand* (gpd/student)	Average Day Flow gpd	(8 hr day) gpm	Peak Day Flow gpd	(8 hr day) gpm	Peak Hour Flow gpd	(8 hr day) gpm
Existing	350	22.75	7,963	16.59	14,333	30	27869	58
Phase I	450	22.75	10,238	21.33	18,428	38	35831	75
Phase II								
Elementary	800	22.75	18,200	37.92	32,760	68	63700	133
High School	650	35	22,750	47.40	40,950	85	79625	166
Total			40,950	85.31	73,710	154	143,325	299

*Includes blowdown waste volume

Existing Water Treatment Design				
Inlet Water	23514	gpd	22,162	
Treated Production Water	17400	gpd DCR	16,400	gpd Ionics
Total Waste	6114	gpd	5,762	
Ratio Blowdown to Water Treated:	26.00%		26.00%	

Effluent Flow and Blowdown Calculations Phase	Average Day WW Flow gpd	Blowdown gpd	Total gpd	Peak Day Total gpd	8 hours Peak Hour Total gpm
Existing	5,892	2,070	7,963	14,333	58
Phase I	7,576	2,662	10,238	18,428	75
Phase II					
Elementary	13,468	4,732	18,200	32,760	133
High School	16,835	5,915	22,750	40,950	166
Total	30,303	10,647	40,950	73,710	299

Monthly Flow at Buildout	school days	calenday days	by schl day gallons	by cal day	Est. Current gal sch d	Actual Water Use gal	Est. Current gal cal d	Est. Buildout gal
Jan	19	31	778,050	1,269,450	151,288		246,838	1,269,450
Feb	19	28	778,050	1,146,600	151,288	334,460	222,950	1,146,600
Mar	21	31	859,950	1,269,450	167,213	299,940	246,838	1,269,450
Apr	20	30	819,000	1,228,500	159,250	285,000	238,875	1,228,500
May	21	31	859,950	1,269,450	167,213	310,000	246,838	1,269,450
June	3	30	122,850	1,228,500	23,888	110,000	119,438	614250
July	0	31	0	1,269,450	0	10,000	10,000	60000
Aug	10	31	409,500	1,269,450	79,625	128,600	123,419	634725
Sept	21	30	859,950	1,228,500	167,213	99,200	238,875	1,228,500
Oct	23	31	941,850	1,269,450	183,138	220,000	246,838	1,269,450
Nov	18	30	737,100	1,228,500	143,325	208,000	238,875	1,228,500
Dec	15	31	614,250	1,269,450	119,438	337,900	246,838	1,269,450
Total Annual	190	365	7,780,500	14,946,750	1,512,875	2,343,100	2,426,619 Adjusted	12,488,325 Adjusted

12.31

Month	Crop Irrigation Demand Bermuda Grass[1] (in/mo)	Crop Irrigation Demand Bermuda Grass[1] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan												
			0	0.89	24,169	0	0	0	0	1,269,450		1,269,450
Feb												
			0	0.96	26,070	0	0	0	0	1,146,600		1,146,600
March												
			0	0.84	22,811	0	0	0	0	1,269,450		1,269,450
April												
	1.94	52,683	52,683	0.33	8,961	43,721	10,930	54,652	672,760	1,228,500	12.31	555,740
May	2.40	65,174										
	3.30	89,615	154,789	0.13	3,530	151,259	37,815	189,074	2,327,499	1,269,450	12.31	0
June	3.80	103,193										
	4.62	125,461	228,654	0.08	2,172	226,481	56,620	283,102	3,484,981	614,250	12.31	0
July	5.00	135,780										
	5.30	143,927	279,707	0.73	19,824	259,883	64,971	324,854	3,998,953	60,000	12.31	0
Aug	4.64	126,004										
	4.34	117,857	243,861	1.21	32,859	211,002	52,751	263,753	3,246,799	634,725	12.31	0
Sept	3.42	92,874										
	2.72	73,864	166,738	0.87	23,626	143,112	35,778	178,890	2,202,140	1,228,500	12.31	0
Oct	2.01	54,584										
			54,584	0.48	13,035	41,549	10,387	51,936	0	1,269,450		1,269,450
Nov												
			0	0.64	17,380	0	0	0	0	1,228,500		1,228,500
Dec												
			0	1.06	28,785	0	0	0	0	1,269,450		1,269,450
Annual			1,181,016 gal/ac/yr	8.21 in/yr				1,346,260 gal/ac/yr	15,933,132 gal/year	12,488,325 gal/yr		8,008,640 gal/yr

24.58 ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on Historical Wastewater Flows and Student Population Projections

12.31

Month	Crop Irrigation Demand Rye[2] (in/mo)	Crop Irrigation Demand Rye[2] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan	2.00	54,312										
			54,312	0.89	24,169	30,143	9,043	39,186	482,382	1,269,450	12.31	787,068
Feb	2.75	74,679										
			74,679	0.96	26,070	48,609	14,583	63,192	777,895	1,146,600	12.31	368,705
March	4.35	118,129										
			118,129	0.84	22,811	95,318	28,595	123,913	1,525,369	1,269,450	12.31	0
April	2.88	78,209										
			78,209	0.33	8,961	69,248	20,774	90,022	0	1,228,500		1,228,500
May												
			0	0.13	3,530	0	0	0	0	1,269,450		1,269,450
June												
			0	0.08	2,172	0	0	0	0	614,250		614,250
July												
			0	0.73	19,824	0	0	0	0	60,000		60,000
Aug												
			0	1.21	32,859	0	0	0	0	634,725		634,725
Sept												
			0	0.87	23,626	0	0	0	0	1,228,500		1,228,500
Oct												
	2.22	60,286	60,286	0.48	13,035	47,251	14,175	61,427	756,166	1,269,450	12.31	513,284
Nov	2.82	76,580										
			76,580	0.64	17,380	59,200	17,760	76,960	947,380	1,228,500	12.31	281,120
Dec	1.75	47,523										
			47,523	1.06	28,785	18,738	5,621	24,359	299,859	1,269,450	12.31	969,591
Annual			509,719 gal/ac/yr	8.21 in/yr				479,060 gal/ac/yr	4,789,049 gal/year	12,488,325 gal/yr		7,955,195 gal/yr

24.41
ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on School Expanson Plan

Month	Bermuda Irrigatable Area (ac)	Rye Irrigatable Area (ac)	Effluent Left Over (gal)	(gpd)
Jan	0.00	12.31	787,068	25,389
Feb	0.00	12.31	368,705	13,168
March	0.00	12.31	0	
April	12.31	0.00	555,740	18,525
May	12.31	0.00	0	
June	12.31	0.00	0	
July	12.31	0.00	0	
Aug	12.31	0.00	0	
Sept	12.31	0.00	0	
Oct	0.00	12.31	513,284	16,558
Nov	0.00	12.31	281,120	9,371
Dec	0.00	12.31	281,120	9,068

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Month	Crop Irrigation Demand Bermuda Grass[1] (in/mo)	Crop Irrigation Demand Bermuda Grass[1] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan			0	0.89	24,169	0	0	0	0	1,269,450		1,269,450
Feb			0	0.96	26,070	0	0	0	0	1,146,600		1,146,600
March			0	0.84	22,811	0	0	0	0	1,269,450		1,269,450
April	1.94	52,683	52,683	0.33	8,961	43,721	10,930	54,652	1,311,636	1,228,500	24.00	0
May	2.40 3.30	65,174 89,615	154,789	0.13	3,530	151,259	37,815	189,074	4,537,773	1,269,450	24.00	0
June	3.80 4.62	103,193 125,461	228,654	0.08	2,172	226,481	56,620	283,102	6,794,439	614,250	24.00	0
July	5.00 5.30	135,780 143,927	279,707	0.73	19,824	259,883	64,971	324,854	7,796,496	60,000	24.00	0
Aug	4.64 4.34	126,004 117,857	243,861	1.21	32,859	211,002	52,751	263,753	6,330,071	634,725	24.00	0
Sept	3.42 2.72	92,874 73,864	166,738	0.87	23,626	143,112	35,778	178,890	4,293,368	1,228,500	24.00	0
Oct	2.01	54,584	54,584	0.48	13,035	41,549	10,387	51,936	0	1,269,450		1,269,450
Nov			0	0.64	17,380	0	0	0	0	1,228,500		1,228,500
Dec			0	1.06	28,785	0	0	0	0	1,269,450		1,269,450
Annual			1,181,016 gal/ac/yr	8.21 in/yr				1,346,260 gal/ac/yr	31,063,783 gal/year	12,488,325 gal/yr		7,452,900 gal/yr 22.87 ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on Historical Wastewater Flows and Student Population Projections

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Month	Crop Irrigation Demand Rye[2] (in/mo)	Crop Irrigation Demand Rye[2] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan	2.00	54,312	54,312	0.89	24,169	30,143	9,043	39,186	940,468	1,269,450	24.00	328,982
Feb	2.75	74,679	74,679	0.96	26,070	48,609	14,583	63,192	1,516,610	1,146,600	24.00	0
March	4.35	118,129	118,129	0.84	22,811	95,318	28,595	123,913	2,973,911	1,269,450	24.00	0
April	2.88	78,209	78,209	0.33	8,961	69,248	20,774	90,022	0	1,228,500		1,228,500
May			0	0.13	3,530	0	0	0	0	1,269,450		1,269,450
June			0	0.08	2,172	0	0	0	0	614,250		614,250
July			0	0.73	19,824	0	0	0	0	60,000		60,000
Aug			0	1.21	32,859	0	0	0	0	634,725		634,725
Sept			0	0.87	23,626	0	0	0	0	1,228,500		1,228,500
Oct	2.22	60,286	60,286	0.48	13,035	47,251	14,175	61,427	1,474,247	1,269,450	24.00	0
Nov	2.82	76,580	76,580	0.64	17,380	59,200	17,760	76,960	1,847,045	1,228,500	24.00	0
Dec	1.75	47,523	47,523	1.06	28,785	18,738	5,621	24,359	584,615	1,269,450	24.00	684,835
Annual			509,719 gal/ac/yr	8.21 in/yr				479,060 gal/ac/yr	9,336,895 gal/year	12,488,325 gal/yr		6,049,242 gal/yr 18.56 ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on School Expanson Plan

Month	Bermuda Irrigatable Area (ac)	Rye Irrigatable Area (ac)	Effluent Left Over (gal)	(gpd)
Jan	0.00	24.00	328,982	10,612
Feb	0.00	24.00	0	0
March	0.00	24.00	0	
April	24.00	0.00	0	0
May	24.00	0.00	0	
June	24.00	0.00	0	
July	24.00	0.00	0	
Aug	24.00	0.00	0	
Sept	24.00	0.00	0	
Oct	0.00	24.00	0	0
Nov	0.00	24.00	0	0
Dec	0.00	24.00	0	0

12.31

Month	Crop Irrigation Demand Bermuda Grass[1] (in/mo)	Crop Irrigation Demand Bermuda Grass[1] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan			0	0.89	24,169	0	0	0	0	1,269,450		1,269,450
Feb			0	0.96	26,070	0	0	0	0	1,146,600		1,146,600
March			0	0.84	22,811	0	0	0	0	1,269,450		1,269,450
April	1.94	52,683	52,683	0.33	8,961	43,721	10,930	54,652	1,228,500	1,228,500	22.48	0
May	2.40 3.30	65,174 89,615	154,789	0.13	3,530	151,259	37,815	189,074	1,269,450	1,269,450	6.71	0
June	3.80 4.62	103,193 125,461	228,654	0.08	2,172	226,481	56,620	283,102	614,250	614,250	2.17	0
July	5.00 5.30	135,780 143,927	279,707	0.73	19,824	259,883	64,971	324,854	60,000	60,000	0.18	0
Aug	4.64 4.34	126,004 117,857	243,861	1.21	32,859	211,002	52,751	263,753	634,725	634,725	2.41	0
Sept	3.42 2.72	92,874 73,864	166,738	0.87	23,626	143,112	35,778	178,890	1,228,500	1,228,500	6.87	0
Oct	2.01	54,584	54,584	0.48	13,035	41,549	10,387	51,936	0	1,269,450		1,269,450
Nov			0	0.64	17,380	0	0	0	0	1,228,500		1,228,500
Dec			0	1.06	28,785	0	0	0	0	1,269,450		1,269,450
Annual			1,181,016 gal/ac/yr	8.21 in/yr				1,346,260 gal/ac/yr	5,035,425 gal/year	12,488,325 gal/yr		7,452,900 gal/yr

22.87 ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on Historical Wastewater Flows and Student Population Projections

Month	Crop Irrigation Demand Rye[2] (in/mo)	Crop Irrigation Demand Rye[2] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	12.31 Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan	2.00	54,312	54,312	0.89	24,169	30,143	9,043	39,186	1,269,450	1,269,450	32.40	0
Feb	2.75	74,679	74,679	0.96	26,070	48,609	14,583	63,192	1,146,600	1,146,600	18.14	0
March	4.35	118,129	118,129	0.84	22,811	95,318	28,595	123,913	1,269,450	1,269,450	10.24	0
April	2.88	78,209	78,209	0.33	8,961	69,248	20,774	90,022	1,228,500	1,228,500	13.65	0
May			0	0.13	3,530	0	0	0	0	1,269,450		1,269,450
June			0	0.08	2,172	0	0	0	0	614,250		614,250
July			0	0.73	19,824	0	0	0	0	60,000		60,000
Aug			0	1.21	32,859	0	0	0	0	634,725		634,725
Sept			0	0.87	23,626	0	0	0	0	1,228,500		1,228,500
Oct	2.22	60,286	60,286	0.48	13,035	47,251	14,175	61,427	1,269,450	1,269,450	20.67	0
Nov	2.82	76,580	76,580	0.64	17,380	59,200	17,760	76,960	1,228,500	1,228,500	15.96	0
Dec	1.75	47,523	47,523	1.06	28,785	18,738	5,621	24,359	1,269,450	1,269,450	52.11	0
Annual			509,719 gal/ac/yr	8.21 in/yr				479,060 gal/ac/yr	8,681,400 gal/year	12,488,325 gal/yr		3,806,925 gal/yr 11.68 ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on Master Plan of Development

Month	Bermuda Irrigatable Area (ac)	Rye Irrigatable Area (ac)	Maximum Irrigatable Area (ac)
Jan	0.00	32.40	32.40
Feb	0.00	18.14	18.14
March	0.00	10.24	10.24
April	22.48	13.65	36.13
May	6.71	0.00	6.71
June	2.17	0.00	2.17
July	0.18	0.00	0.18
Aug	2.41	0.00	2.41
Sept	6.87	0.00	6.87
Oct	0.00	20.67	20.67
Nov	0.00	15.96	15.96
Dec	0.00	52.11	52.11

24

Month	Crop Irrigation Demand Bermuda Grass[1] (in/mo)	Crop Irrigation Demand Bermuda Grass[1] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan			0	0.89	24,169	0	0	0	0	1,269,450		1,269,450
Feb			0	0.96	26,070	0	0	0	0	1,146,600		1,146,600
March			0	0.84	22,811	0	0	0	0	1,269,450		1,269,450
April	1.94	52,683	52,683	0.33	8,961	43,721	10,930	54,652	1,311,636	1,228,500	24.00	0
May	2.40 3.30	65,174 89,615	154,789	0.13	3,530	151,259	37,815	189,074	4,537,773	1,269,450	24.00	0
June	3.80 4.62	103,193 125,461	228,654	0.08	2,172	226,481	56,620	283,102	6,794,439	614,250	24.00	0
July	5.00 5.30	135,780 143,927	279,707	0.73	19,824	259,883	64,971	324,854	7,796,496	60,000	24.00	0
Aug	4.64 4.34	126,004 117,857	243,861	1.21	32,859	211,002	52,751	263,753	6,330,071	634,725	24.00	0
Sept	3.42 2.72	92,874 73,864	166,738	0.87	23,626	143,112	35,778	178,890	4,293,368	1,228,500	24.00	0
Oct	2.01	54,584	54,584	0.48	13,035	41,549	10,387	51,936	0	1,269,450		1,269,450
Nov			0	0.64	17,380	0	0	0	0	1,228,500		1,228,500
Dec			0	1.06	28,785	0	0	0	0	1,269,450		1,269,450
Annual			1,181,016 gal/ac/yr	8.21 in/yr				1,346,260 gal/ac/yr	31,063,783 gal/year	12,488,325 gal/yr		7,452,900 gal/yr

22.87 ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on Historical Wastewater Flows and Student Population Projections

24

Month	Crop Irrigation Demand Rye[2] (in/mo)	Crop Irrigation Demand Rye[2] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan	2.00	54,312	54,312	0.89	24,169	30,143	9,043	39,186	940,468	1,269,450	24.00	328,982
Feb	2.75	74,679	74,679	0.96	26,070	48,609	14,583	63,192	1,516,610	1,146,600	24.00	0
March	4.35	118,129	118,129	0.84	22,811	95,318	28,595	123,913	2,973,911	1,269,450	24.00	0
April	2.88	78,209	78,209	0.33	8,961	69,248	20,774	90,022	0	1,228,500		1,228,500
May			0	0.13	3,530	0	0	0	0	1,269,450		1,269,450
June			0	0.08	2,172	0	0	0	0	614,250		614,250
July			0	0.73	19,824	0	0	0	0	60,000		60,000
Aug			0	1.21	32,859	0	0	0	0	634,725		634,725
Sept			0	0.87	23,626	0	0	0	0	1,228,500		1,228,500
Oct	2.22	60,286	60,286	0.48	13,035	47,251	14,175	61,427	1,474,247	1,269,450	24.00	0
Nov	2.82	76,580	76,580	0.64	17,380	59,200	17,760	76,960	1,847,045	1,228,500	24.00	0
Dec	1.75	47,523	47,523	1.06	28,785	18,738	5,621	24,359	584,615	1,269,450	24.00	684,835
Annual			509,719 gal/ac/yr	8.21 in/yr				479,060 gal/ac/yr	9,336,895 gal/year	12,488,325 gal/yr		6,049,242 gal/yr 18.56 ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on School Expanson Plan

Month	Bermuda Irrigatable Area (ac)	Rye Irrigatable Area (ac)	Effluent Left Over (gal)	(gpd)
Jan	0.00	24.00	328,982	10,612
Feb	0.00	24.00	0	0
March	0.00	24.00	0	
April	24.00	0.00	0	0
May	24.00	0.00	0	
June	24.00	0.00	0	
July	24.00	0.00	0	
Aug	24.00	0.00	0	
Sept	24.00	0.00	0	
Oct	0.00	24.00	0	0
Nov	0.00	24.00	0	0
Dec	0.00	24.00	0	0

Month	Crop Irrigation Demand Rye[2] (in/mo)	Crop Irrigation Demand Rye[2] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area (ac)	Average Effluent Left Over (gal/mo)
Jan	2.00	54,312	54,312	0.89	24,169	30,143	9,043	39,186	1,269,450	1,269,450	32.40	0
Feb	2.75	74,679	74,679	0.96	26,070	48,609	14,583	63,192	1,146,600	1,146,600	18.14	0
March	4.35	118,129	118,129	0.84	22,811	95,318	28,595	123,913	1,269,450	1,269,450	10.24	0
April	2.88	78,209	78,209	0.33	8,961	69,248	20,774	90,022	1,228,500	1,228,500	13.65	0
May			0	0.13	3,530	0	0	0	0	1,269,450		1,269,450
June			0	0.08	2,172	0	0	0	0	614,250		614,250
July			0	0.73	19,824	0	0	0	0	60,000		60,000
Aug			0	1.21	32,859	0	0	0	0	634,725		634,725
Sept			0	0.87	23,626	0	0	0	0	1,228,500		1,228,500
Oct	2.22	60,286	60,286	0.48	13,035	47,251	14,175	61,427	1,269,450	1,269,450	20.67	0
Nov	2.82	76,580	76,580	0.64	17,380	59,200	17,760	76,960	1,228,500	1,228,500	15.96	0
Dec	1.75	47,523	47,523	1.06	28,785	18,738	5,621	24,359	1,269,450	1,269,450	52.11	0
Annual			509,719 gal/ac/yr	8.21 in/yr				479,060 gal/ac/yr	8,681,400 gal/year	12,488,325 gal/yr		3,806,925 gal/yr 11.68 ac-ft/yr

1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on Master Plan of Development

Month	Crop Irrigation Demand Bermuda Grass[1] (in/mo)	Crop Irrigation Demand Bermuda Grass[1] (gal/ac)	Monthly Cumulative (gal/ac/mo)	Precipitation[3] (in/mo)	Precipitation[3] (gal/ac/mo)	Irrigation Demand (gal/ac/mo)	Loss Due to Irrig. Pract.[4] (gal/ac/mo)	Total Irrig. Demand (gal/ac/mo)	Total Irrigation Demand (gal/mo)	Average Effluent Available[5] (gal/mo)	Irrigatable Area Required (ac)	Average Effluent Left Over (gal/mo)
Jan			0	0.89	24,169	0	0	0	0	1,269,450		1,269,450
Feb			0	0.96	26,070	0	0	0	0	1,146,600		1,146,600
March			0	0.84	22,811	0	0	0	0	1,269,450		1,269,450
April	1.94	52,683	52,683	0.33	8,961	43,721	10,930	54,652	1,228,500	1,228,500	22.48	0
May	2.40 3.30	65,174 89,615	154,789	0.13	3,530	151,259	37,815	189,074	1,269,450	1,269,450	6.71	0
June	3.80 4.62	103,193 125,461	228,654	0.08	2,172	226,481	56,620	283,102	614,250	614,250	2.17	0
July	5.00 5.30	135,780 143,927	279,707	0.73	19,824	259,883	64,971	324,854	60,000	60,000	0.18	0
Aug	4.64 4.34	126,004 117,857	243,861	1.21	32,859	211,002	52,751	263,753	634,725	634,725	2.41	0
Sept	3.42 2.72	92,874 73,864	166,738	0.87	23,626	143,112	35,778	178,890	1,228,500	1,228,500	6.87	0
Oct	2.01	54,584	54,584	0.48	13,035	41,549	10,387	51,936	1,269,450	1,269,450	24.44	0
Nov			0	0.64	17,380	0	0	0	0	1,228,500		1,228,500
Dec			0	1.06	28,785	0	0	0	0	1,269,450		1,269,450
Annual			1,181,016 gal/ac/yr	8.21 in/yr				1,346,260 gal/ac/yr	6,304,875 gal/year	12,488,325 gal/yr		6,183,450 gal/yr 18.98 ac-ft/yr

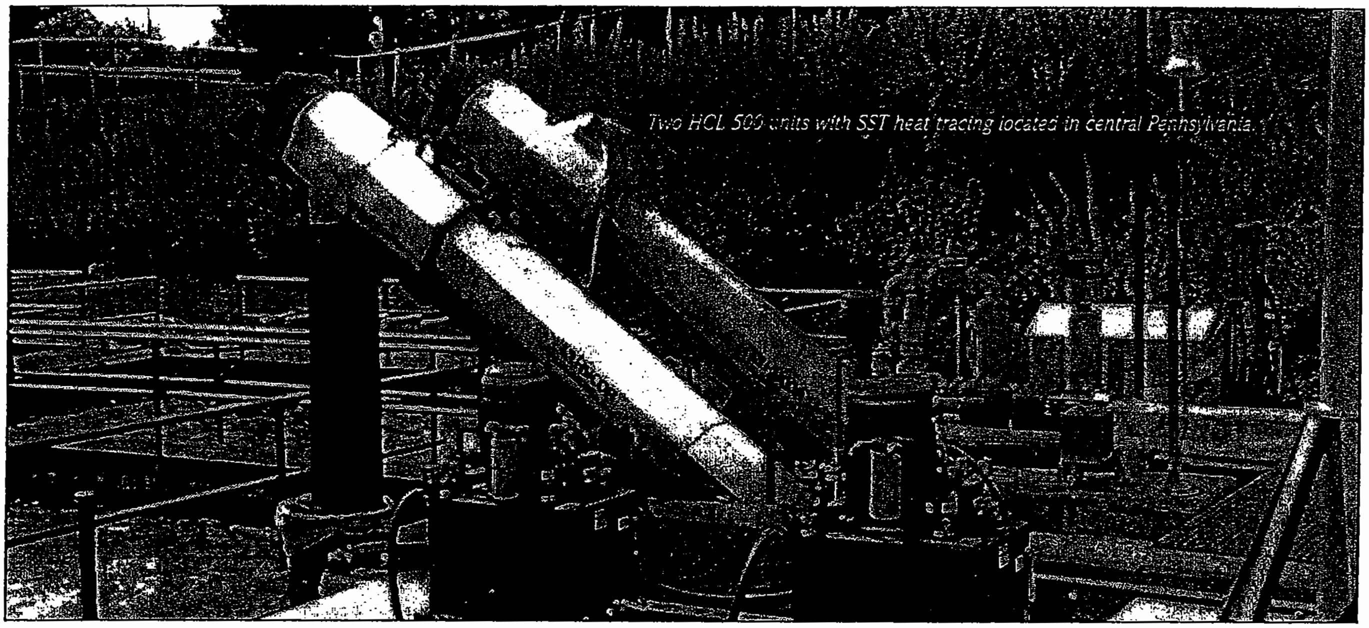
1) United States Department of Agriculture, Conservation Research Report Number 29
2) University of Arizona, Conservation Research
3) Climate data for the Litchfield Park Station, 1917 to 2000
4) Irrigation Losses Assumed to be 25% for sprinklers
5) Flow data based on Historical Wastewater Flows and Student Population Projections

Month	Bermuda Irrigatable Area (ac)	Rye Irrigatable Area (ac)	Required Irrigatable Area (ac)
Jan	0.00	32.40	32.40
Feb	0.00	18.14	18.14
March	0.00	10.24	10.24
April	22.48	13.65	36.13
May	6.71	0.00	6.71
June	2.17	0.00	2.17
July	0.18	0.00	0.18
Aug	2.41	0.00	2.41
Sept	6.87	0.00	6.87
Oct	24.44	20.67	45.11
Nov	0.00	15.96	15.96
Dec	0.00	52.11	52.11

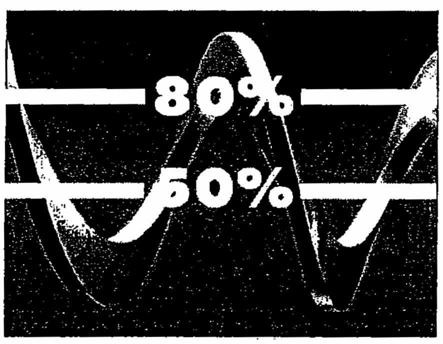
PARKSON CORPORATION

Heliclean®

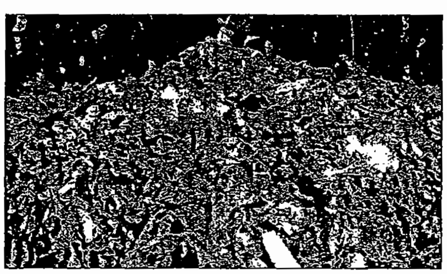
Turbo-Washing Headworks Screening System



Two HCL 500 units with SST heat tracing located in central Pennsylvania.



The Heliclean reduces the weight of screenings up to 80% and volume as much as 50%



Clean, odor-free screenings

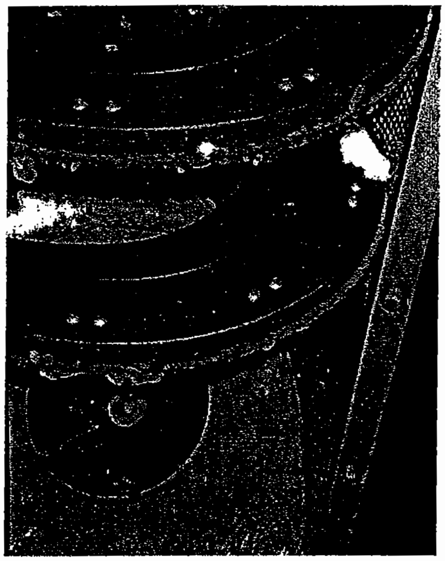
The Heliclean system is the solution to separating most putrescible organics from primary screenings and returning the organics to the biological process. Solids are washed and rinsed by the natural influent flow using the Heliclean's vigorous turbo-washing agitation – at 1800 rpm. The turbo-washing breaks up solids and releases organics back into the wastewater flow. The washed screenings are transported via the shaftless spiral to the integral dewatering zone and final discharge.

The result is reduced solids going into landfill. Washing has been found to reduce volume as much as 50% and weight up to 80%. The Heliclean system produces relatively odorless, dry solids which are free of excessive organics and acceptable for landfill.

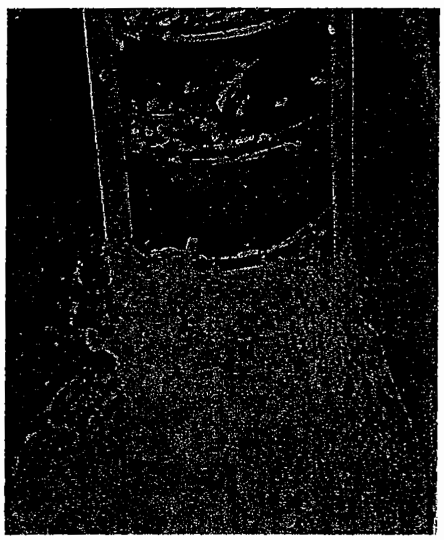
Principles of Operation

Solids are captured on the Heliclean fine screen. The influent level rises until a level switch activates the turbo-washer and spiral drive. The spiral turns in a reverse direction forcing the solids into the turbo washing impeller. As separation occurs, the liquid and fine organics pass through the screen. When the liquid level drops to a predetermined point, the motor stops. On the final wash cycle, the well washed screenings are conveyed out of the screening zone.

The shaftless spiral eliminates bottom support and hanger bearings which require frequent greasing and are subject to mechanical wear. Fibrous and bulky solids have a clear, barrier-free path to the dewatering zone. There is no shaft around which long, stringy solids can wind. The result is high capacity with efficiency and economy of operation. Rugged brushes mounted on the spiral flights in the screen zone keep the screen clean.



Agitator mehanism in enfluent channel



Turbo agitation achieves maximum cleaning efficiency

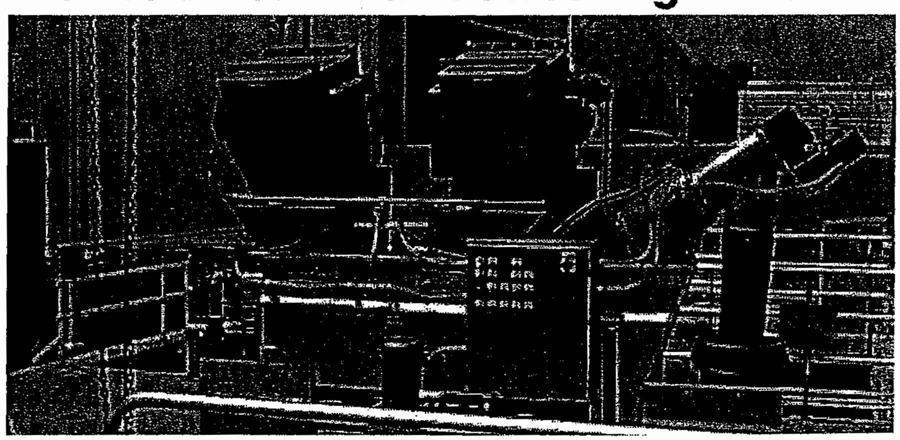
The Heliclean system totally encloses solids from screen to discharge. The transport tube is stainless steel, designed to resist corrosion and wear. The spiral is steel alloy fabricated in continuous flights for a strong stable structure. Fewer moving parts means less maintenance. Because the screen and transport tube assembly pivot easily out of the channel, there is no need for a by-pass channel.

In addition to acting as a solids washer, the Heliclean system screens, conveys and dewaters the captured solids so that the weight and volume of the final screenings are greatly reduced and they are discharged with maximum dryness and minimum odor.

The combination of the Heliclean turbo-washing and screening, conveying, dewatering processes provides clean screenings with little odor. Clean screenings can be stored for longer periods of time than raw, unwashed solids and are less attractive to insects and rodents.

- **Highest quality screenings washing with vigorous impeller turbo agitation**
- **Separates organic matter from the screenings and returns it to the biological process**
- **Minimizes odors**
- **Reduces weight up to 80% and volume up to 50%**
- **No center shaft to wrap or trap long, stringy materials**
- **Stainless steel housing and tank: carbon steel shaftless spiral and cast iron impeller**

Heliclean Plus In-Tank Screenings Washer



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AUTO-RAKE® Model 1200

Advanced Mechanical Bar Screen

With it's modern streamlined design, the Auto-Rake is strikingly different yet remarkable for its rugged simplicity.

Built for low maintenance even in hostile environments, the Auto-Rake employs the latest front cleaned bar screen technology to remove solids from liquid channels.

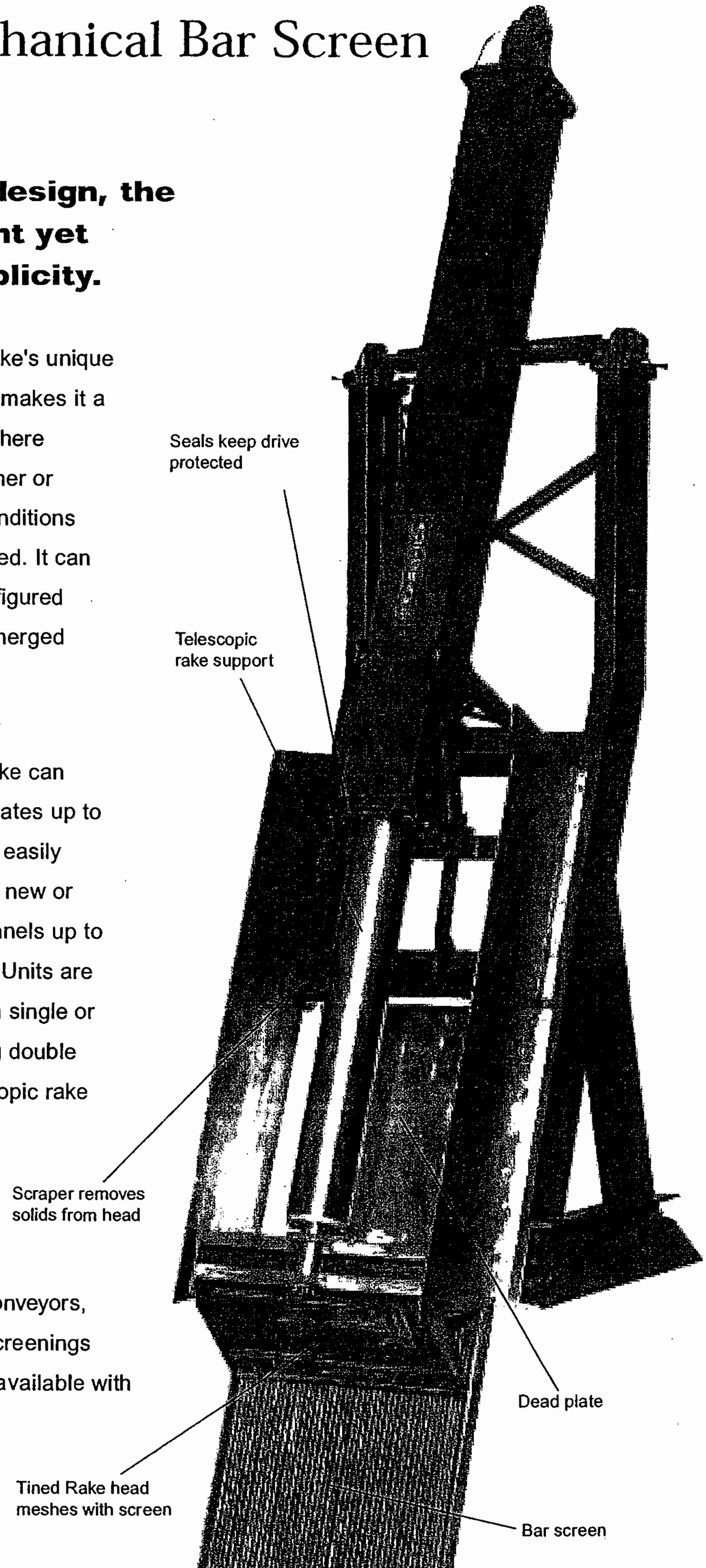
By coordinating the motion of a sliding rake cylinder and a pivoted boom, the Auto-Rake creates a smooth and versatile raking motion.

Unlike other bar screen designs, the Auto-Rake uses no racks, chains, or tracks that can corrode, wear or become misaligned. Instead, the entire drive mechanism is enclosed in a sealed boom housing.

The Auto-Rake's unique sealed drive makes it a top choice where severe weather or operating conditions are anticipated. It can even be configured for fully submerged operation.

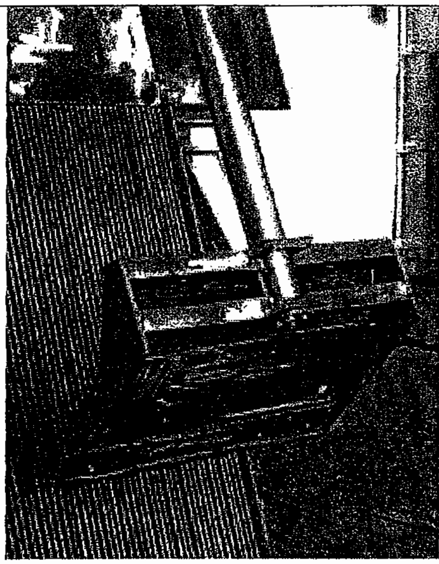
FLEXIBILITY

The Auto-Rake can handle flow rates up to 50 mgd. It is easily installed into new or existing channels up to 52" in width. Units are supplied with single or space saving double acting telescopic rake cylinders.

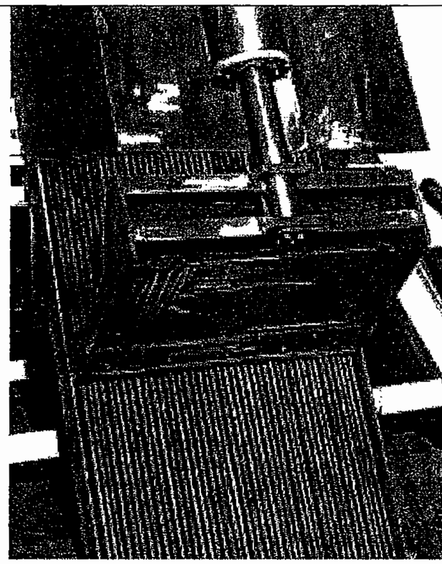


OPTIONS

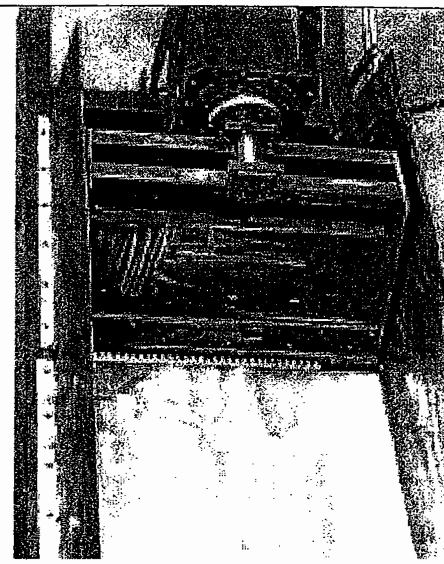
The Auto-Rake can be supplied with auxiliary lift conveyors, dewatering equipment, washer and Taskmaster® screenings grinder to meet almost any requirement. Units are available with electric or hydraulic drives.



As the unit descends the boom pivots out.



Solids captured on the screen are lifted by the rake.



A scraper at the top of the stroke removes solids from the rake head.

FEATURES	*ADVANTAGES*
■ FULLY SEALED DESIGN	■ PROTECTED FROM ELEMENTS FOR GREATER RELIABILITY
■ TELESCOPIC BOOM & CYLINDER	■ COMPACT DESIGN ENDS ALIGNMENT PROBLEMS
■ STAINLESS WETTED PARTS	■ REDUCES CORROSION
■ NO PIN RACKS OR GEARING	■ LOWER MAINTENANCE
■ SCREENS TO 1/2"	■ REDUCES LABOR & IMPROVES PLANT OPERATION

SPECIAL SEQUENCING

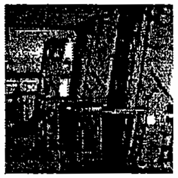
If an immovable object is encountered in the screening cycle, the Auto-Rake's rake head is free to simply lift over it and continue its cycle without interruption. If the rake head does not reach it's full extension in a given period of time, an alarm contact is energized to signal the operator of an obstruction.

CONTROLS

An included program controller sequences all system functions in standard and special operating modes. An included timer function allows the operator to program for timed raking action. Contacts are provided for incorporation of a high flow sensing device.

The controller is supplied complete with a Nema 4 enclosure.

Franklin Miller Since 1918



Climber Screen®
Mechanical Bar Screen

Reduce costs and complications in severe applications

- CSO or stormwater treatment
- Excessive grit or large debris removal
- Deep water or low headroom installations
- Fine, medium, and coarse wastewater screening
- Sanitary applications

ONDEO Degrémont

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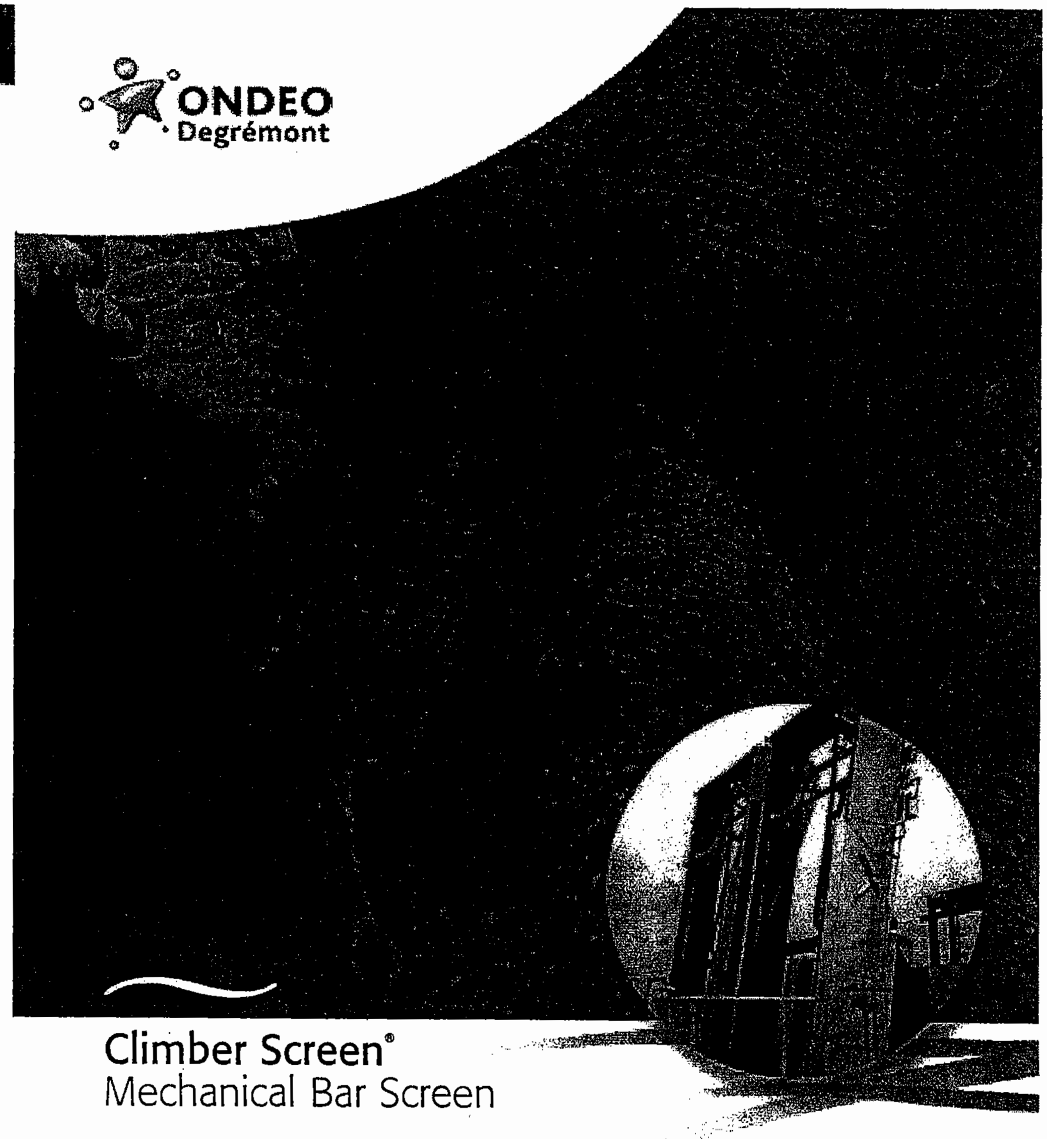
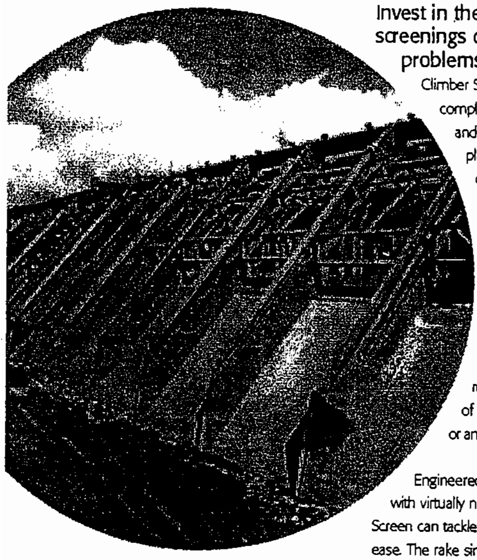


Climber Screen®
Mechanical Bar Screen

Sanitary applications Stormwater treatment Raw water intakes

SUEZ

Climber Screen® Mechanical Bar Screen



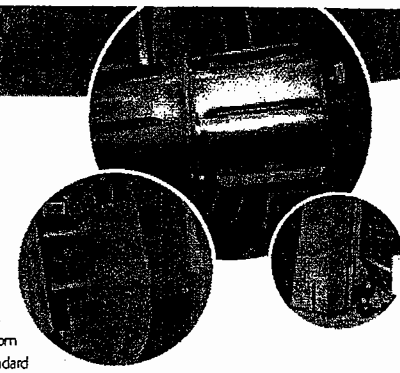
Invest in the leader: maximize screenings capture, minimize problems

Climber Screen reduces costs and complications for pump stations and wastewater treatment plants by removing channel debris before it can damage downstream equipment. The smooth-running, endless track system employs a gear-driven cleaning rake to carry screenings from the bar rack to a discharge chute for removal — without the use of chains, sprockets, cables, or any underwater moving parts.

Engineered for years of severe duty with virtually no maintenance, Climber Screen can tackle large obstructions with ease. The rake simply disengages from the bar rack to clear the object until it can be removed on a subsequent pass. An object too large for the rake to clear will activate an alarm to reverse the unit, facilitating access for manual removal.

Two decades of proven performance set Climber Screen apart

- **Positive screenings discharge.** A hinged wiper assembly — equipped with shock absorbers — engages the rake shelf at the screenings discharge point. By minimizing carryover, you get a cleaner channel in less run time.
- **Precision engineering.** The heavy-duty gear and pin rack operates without chains, sprockets, or cables, so carriage vibration is minimal. Smooth operation minimizes mechanical problems, noise, and wear - even in severe conditions.
- **Above-water operation.** All moving parts — the pin rack, involute gears, and wiper assembly — remain above the maximum water level during operation. These finely tuned components last longer with less maintenance and repair.
- **Flexible design.** Climber Screen is custom manufactured and can retrofit to nearly any size application with little, if any, channel modifications. Bar rack openings range from ¼ inch to six inches in standard and severe-duty styles, based on individual plant flow and debris conditions.
- **Easy to install, control, and maintain.** The unit is either shipped assembled or in as few components as possible, making installation quick and easy. Automatic controls require minimal operator attention. An integral brake motor stops the unit at any level so all maintenance can be performed from the easiest access point.



Motor submergence protection

These optional features are designed to protect Climber Screen's carriage-mounted drive motor if maximum water levels are exceeded.

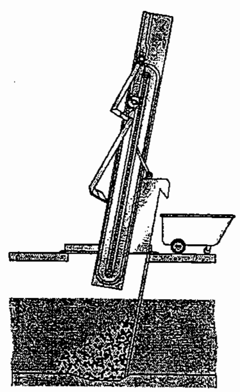
Auto Retreat™
If it senses a water increase above maximum designated levels, this carriage-mounted probe signals the carriage system to retreat via the shortest path.

Auto-Reverse™
During overload conditions that cause water levels to rise, Auto-Reverse will automatically reverse the carriage to the park position.

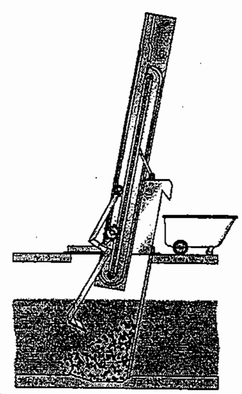
Patented Motor Enclosure
This patented housing is constructed with two stainless steel sections for corrosion resistance and easy access for maintenance.

Hydraulic Drive
A hydraulic drive system is available for installations with frequent flood potential.

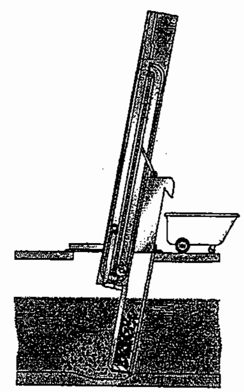
Call Ondeo Degremont to find out more.



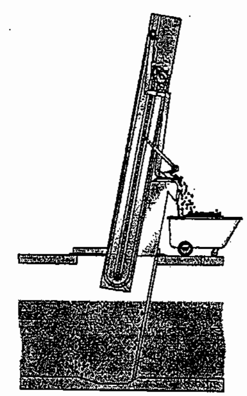
1 Cogwheels move the rake arm down the pin rack upon activation.



2 The rake arm enters the channel upstream from the screen.



3 At the bottom of the pin rack, the rake engages the screen.



4 Cogwheels walk the rake arm up the pin rack, transporting screenings for removal.

INFILTRATOR SYSTEMS INC

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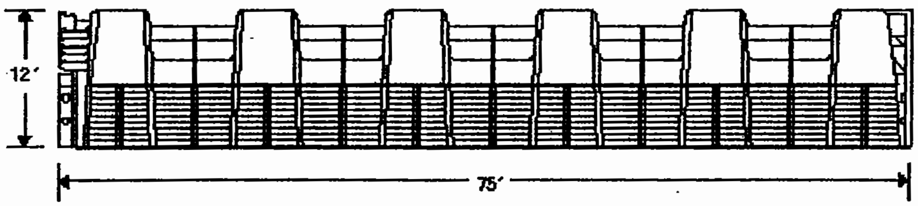
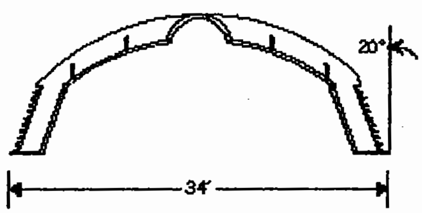
Standard Infiltrator Chamber® and End Plate Specifications.

Chamber Side View



Chamber End View



Product Benefits

- Lightweight units offer easy assembly and installation.
- Louvered MicroLeaching(TM) sidewall provides maximum infiltration.
- Open chamber bottom allows additional infiltrative area.
- PolyTuff(TM) plastic construction (a proprietary blend of polyolefin) guarantees strength and durability.

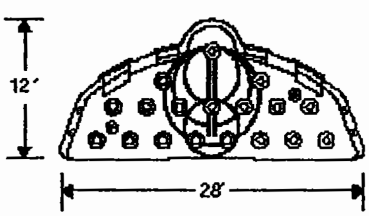
Standard Infiltrator Chamber Specifications

Size (W x L x H)	34" x 75" x 12"
Invert*	7.25"
Storage	77 gal/10.3 ft ^{3}
Weight	25 lb

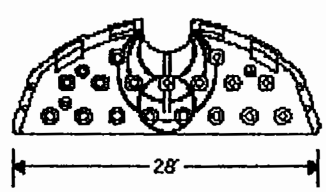
* 4" SDR 35 pipe

End Plate End Views

Closed End Plate



Open End Plate



GUEST REGISTER

Click here to sign the Infiltrator guest register and receive additional technical, product, and company material.

LITERATURE LIBRARY

Click here to reference product, company, and technical support documentation. These files may be downloaded for your viewing convenience.

800 NUMBER

Click here to access Infiltrator Systems' contact information page. Call **1-800-718-2754** to speak directly with a customer representative for information specific to your area.

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Appendix B
Ashbrook Cut Sheets

HENNESY MECHANICAL SALES, L.L.C.
3420 EAST SHEA BLVD. #100
PHOENIX, AZ 85028
TEL 602-996-3444
FAX 602-996-9408

fax transmittal

to:	FLUID SOLUTIONS Attn: Kathy Hendricks
fax #:	274-6773,PHONE274-6725
from:	Pat Hennesy
date:	December 10, 2003
re:	RUTH FISCHER SCHOOL WWTP
pages:	1, including this cover sheet

NOTES: The budget estimate for a Schloss Mark IX-A bar screen with fully enclosed housing similar to the pictures sent to you earlier today is $45,000.00. Above grade enclosure is galvanized steel, the bar rack is 304 stainless steel and the control panel is enclosed in a NEMA 4 stainless steel enclosure.

Please call with any questions. Thanks.

HENNESY MECHANICAL SALES, L.L.C.
3420 EAST SHEA BLVD. #100
PHOENIX, AZ 85028
TEL 602-996-3444
FAX 602-996-9408

fax transmittal

to:	FLUID SOLUTIONS Attn: Kathy Hendricks
fax #:	274-6773, PHONE 274-6725
from:	Pat Hennesy
date:	October 29, 2003
re:	RUTH FISCHER SCHOOL WWTP
pages:	2, including this cover sheet

NOTES: Per our conversation.

Ashbrook Corporation

Activated Sludge Design

Ashbrook Simon-Hartley

Printed: 10/29/2003, 1:31 PM

Project: Ruth Fischer School, AZ - A+ Effluent Option R1
Engineer:
Computed By: Jeanette Vargo
Conditions: Package Plant - Average Conditions

Influent Characteristics:

Flow:	42,000	GPD		29	GPM
BOD5:	300	mg/L		105	Lbs/Day
TSS:	300	mg/L		105	Lbs/Day
TKN:	40	mg/L	*	14	Lbs/Day
Ammonia:	25	mg/L	*	9	Lbs/Day
Phosphourus	10	mg/L	*	4	Lbs/Day
Alkalinity:	250	mg/L	*	88	Lbs/Day

Projected Effluent Quality:

BOD5:	<	15	mg/L
TSS:	<	15	mg/L
Nitrate-N:	<	10	mg/L
TKN:	<	8.0	mg/L
Ammonia:	<	1.0	mg/L
Phosphorus	<	1.0	mg/L
Alkalinity:	<	168	mg/L

Design Parameters:

MLSS Temperature:	15	°C
Site Elevation:	500	Ft. MSL
alpha:	0.85	
beta:	0.95	
Minimum Residual DO:	2.0	mg/L

Steady-State Operating Characteristics:

Organic Loading Rate:	24.5	Lb BOD5/d/1000 Ft^3
Total HRT:	18	Hours
Anoxic HRT:	4	Hours
SRT:	5	Day
MLSS:	2,000	mg/L
RAS TSS:	8000	mg/L
RAS Rate:	0.012	MGD
RAS Rate:	8.2	GPM
WAS Loading:	104	Lbs/Day
WAS Rate	1,554	GPD
Yield Lb WAS/Lb BOD:	0.99	Lb/Lb
AOR:	6.2	Lbs/Hr
Lb AOR/Lb BOD5:	1.14	Lb/Lb
Field Correction Factor:	0.63	
SOR	9.7	Lbs/Hr
SOTE	6.4	%
MLSS Recycle Flow	0.17	MGD
Diffuser Submergence	8.50	Ft
Side Water Depth:	9.5	Ft

Plant Design

Number of Aeration Tanks:	1			
Volume Per Aeration Tank:	3,363	Ft^3	25,155	Gal
Anoxic Volume:	936	Ft^3	7,000	Gal
Total Reactor Volume:	4,298	Ft^3	32,155	Gal
Digester Volume:	1,454	Ft^3	10,879	Gal
Post Aeration Volume:	0	Ft^3	0	Gal
Pre-Equalization Volume:	1,872	Ft^3	14,000	Gal
Clarifier Volume	936	Ft^3	7,000	Gal
Clarifier Retention at Peak Flow:	2.27	Hr		
Clarifier Surface Area:	105	Ft^2		
Clarifier Diameter:	12	Ft		
Minimum Clarifier Inlet Pipe:	2.8	In		
Min Clarifier Stilling Well:	16	In		
Est. Thickened WAS conc.:	18,000	mg/L		
Required Digester Storage:	20	Days		
VS Reduction in Digester:	28	%		
Total Required Air:	263	SCFM		
Reactor Air Requirement:	146	SCFM		
Digester Air Requirement:	44	SCFM		
Post Aeration Air Req'd:	0	SCFM		
Equalization Air Required:	28	SCFM		
Airlift Requirement:	45	SCFM		
Blower Discharge Pressure:	5.23	PSIA		
Total Approx Blower BHP:	9.3	HP		
Reactor Blower BHP:	6.8	HP		
Digester Blower BHP:	1.5	HP		

To meet the required effluent limits, an SSF 12 with polymer feed will be required.

NOTE: Reactor is defined as the sum of all aeration basins plus the anoxic basins.
* Value is assumed

HENNESY MECHANICAL SALES, L.L.C.

3420 EAST SHEA BLVD. #100
PHOENIX, AZ 85028
TEL 602-996-3444
FAX 602-996-9408

fax transmittal

to:	FLUID SOLUTIONS Attn: Kathy Hendricks
fax #:	274-6773, phone 274-6725
To: ~~from~~:	Pat Hennesy
date:	October 27, 2003
re:	RUTH FISCHER SCHOOL WWTP
pages:	2 ~~4~~, including this cover sheet

NOTES: Attached please find the Ashbrook proposal for the above packaged wastewater treatment plant. Please note that it includes UV disinfection and a tertiary filter for class A+ effluent. Please call with any questions. Thanks.

Two comments: Use 15°C as the low design temp.
2000 mg/l MLSS (F:M ratio limits)

Thanks
Kathy

Ashbrook Corporation

Activated Sludge Design

Ashbrook Simon-Hartley

Printed: 10/22/2003, 8:57 AM

Project: Ruth Fischer School, AZ - A+ Effluent Option
Engineer:
Computed By: Jeanette Vargo
Conditions: Package Plant - Average Conditions

Influent Characteristics:

Flow:	42,000	GPD		29	GPM
BOD5:	300	mg/L		105	Lbs/Day
TSS:	300	mg/L		105	Lbs/Day
TKN:	40	mg/L	*	14	Lbs/Day
Ammonia:	25	mg/L	*	9	Lbs/Day
Phosphourus	10	mg/L	*	4	Lbs/Day
Alkalinity:	250	mg/L	*	88	Lbs/Day

Projected Effluent Quality:

BOD5:	<	15	mg/L
TSS:	<	15	mg/L
Nitrate-N:	<	10	mg/L
TKN:	<	8.0	mg/L
Ammonia:	<	1.0	mg/L
Phosphorus	<	1.0	mg/L
Alkalinity:	<	153	mg/L

Design Parameters: 15° C

MLSS Temperature:	20	°C
Site Elevation:	500	Ft. MSL
alpha:	0.85	
beta:	0.95	
Minimum Residual DO:	2.0	mg/L

Steady-State Operating Characteristics:

Organic Loading Rate:		32.1	Lb BOD5/d/1000 Ft^3
Total HRT:	27.7	14	Hours
Anoxic HRT:	8.9	4	Hours
SRT:		5	Day
MLSS:	2000	2,500	mg/L
RAS TSS:		8000	mg/L
RAS Rate:		0.017	MGD
RAS Rate:		11.5	GPM
WAS Loading:		97	Lbs/Day
WAS Rate		1,460	GPD
Yield Lb WAS/Lb BOD:		0.93	Lb/Lb
AOR:		6.5	Lbs/Hr
Lb AOR/Lb BOD5:		1.22	Lb/Lb
Field Correction Factor:		0.63	
SOR		10.5	Lbs/Hr
SOTE		6.4	%
MLSS Recycle Flow		0.17	MGD
Diffuser Submergence		8.50	Ft
Side Water Depth:		9.5	Ft

Plant Design

Number of Aeration Tanks:	1			
Volume Per Aeration Tank:	2,339	Ft^3	17,500	Gal
Anoxic Volume:	936	Ft^3	7,000	Gal
Total Reactor Volume:	3,275	Ft^3	24,500	Gal
Digester Volume:	1,062	Ft^3	7,942	Gal
Post Aeration Volume:	0	Ft^3	0	Gal
Pre-Equalization Volume:	1,872	Ft^3	14,000	Gal
Clarifier Volume	936	Ft^3	7,000	Gal
Clarifier Retention at Peak Flow:	2.27	Hr		
Clarifier Surface Area:	105	Ft^2		
Clarifier Diameter:	12	Ft		
Minimum Clarifier Inlet Pipe:	2.9	In		
Min Clarifier Stilling Well:	17	In		
Est. Thickened WAS conc.:	18,000	mg/L		
Required Digester Storage:	15	Days	20 days	
VS Reduction in Digester:	28	%		
Total Required Air:	262	SCFM		
Reactor Air Requirement:	157	SCFM		
Digester Air Requirement:	32	SCFM		
Post Aeration Air Req'd:	0	SCFM		
Equalization Air Required:	28	SCFM		
Airlift Requirement:	45	SCFM		
Blower Discharge Pressure:	5.23	PSIA		
Total Approx Blower BHP:	9.3	HP		
Reactor Blower BHP:	7.2	HP		
Digester Blower BHP:	1.1	HP		

To meet the required effluent limits, an SSF 12 with polymer feed will be required.

NOTE: Reactor is defined as the sum of all aeration basins plus the anoxic basins.
* Value is assumed

BUDGETARY PROPOSAL

DATE: October 27, 2003

FROM: Charles M. Clay, P.E.

TO: Pat Hennesy

COMPANY: Hennesy Mechanical, Inc.

SUBJECT: Ruth Fisher School

QUOTE #: 2003-1238

 # OF PAGES INCLUDING THIS PAGE: 2

Ashbrook Simon-Hartley
OPTIMIZED PROCESS RESULTS

Process Systems Group
11600 East Hardy
Houston, Texas 77093-1098
Phone: (281) 985-4455
Fax: (281) 985-4431
Email: charles.clay@ashbrookcorp.com

Pat:

In response to your inquiry for a 42,000 gpd complete mix activated sludge treatment system with a Peak loading of 74,000 gpd and capable of treating an influent quality of 300 mg/l BOD_5, 300 mg/l TSS and 40 mg/l TKN domestic wastewater, we are pleased to propose one (1) Hydro-Aerobics™ model H-42-SUSHC **Secondary System** with one (1) Strata-Sand SSF-12 **Tertiary Filter Systems**.

This complete system has a projected effluent quality of A+ for reuse and meets Title 22 stringent requirements for tertiary filtration. **Please see Ashbrook Corp. Activated Sludge Design attached for more details.**

The following equipment is included in the above system:

Secondary System Equipment

- 12,600 gallon flow equalization chamber
- Duplex ½ hp flow equalization pumps
- EQ blower motor unit (with Controls)
- 7,000 gallon Anoxic Chamber
- 2 hp Mixer unit with controls
- 17,500 gallon Aeration Chamber
- Duplex 10 hp blower motor units (157 SCFM @ 5 PSIG)
- Main blower control panel
- 7,942 gallon Sludge holding tank
- 2" supernatant decant airlift
- 7,000 gallon hopper bottom clarifiers
- sludge airlift pump & piping
- scum airlift & piping
- 875 gallon UV Chamber with UV unit
- Galvanized grating with perimeter handrail
- Access stairway
- Epoxy coating (includes sandblast) for above grade mounting

BUDGETARY PROPOSAL

Ashbrook Simon-Hartley
OPTIMIZED PROCESS RESULTS

Tertiary Filter System Equipment

- 12 ft^2 filter cells
- Carbon Steel chamber
- Duplex compressor motor units 2 hp
- Tertiary control panel
- Polymer feed system
- Access latter
- Epoxy coating (includes sandblast) for above grade mounting

Budget price for the **Secondary &Tertiary System** is $189,000.00, estimated freight to Ruth Fischer School, AZ, (not offloaded), and one day of startup service by an Ashbrook Corporation service technician.

Deduct $8,000.00 for if Chlorination System is used in lieu of UV.

General Notes

1) Excavation, foundation pad, crane off-loading, field welding, touch-up paint, plumbing to the plant, connection of anodes, installation of grating, handrail and component equipment, electrical wiring, and filling of the tank for testing are to be done by the general contractor.
2) There is no provision included in this budgeted price, unless noted, for field erection supervision, tests, inspections or adjustments of equipment. If factory representative is required for any of these services, please refer to "Service Terms" enclosed. The equipment offered by Ashbrook Corporation is our standard design, materials and manufacture. In the event that these items of equipment are subject to any alteration in design or materials or manufacture by the contractor, owner, owner's agent or engineer, such alterations shall be subject to change in the contract price and/or delivery schedule.
3) This Secondary system will measure approximately 85' long x 12' wide x 11' tall, weighing approximately 54,000 lbs. empty, and will be delivered to the jobsite in two (2) sections. Field welding by others
4) The Tertiary will measure 4' diameter x 11' tall, and will weigh approximately 13,000 lbs. empty and will be delivered to the jobsite in one (1) section.

Let me know if there's any other information you'll need.

Sincerely
Ashbrook Corporation

Charles M. Clay, P.E.
Senior Project Manager
Process Systems Group

Appendix C

Financial Statement

Saddle Mountain Unified School District #90

A Learning Community
District Office
38201 W. Indian School Rd.
Tonopah, AZ 85354
(623)386-5688

June 18th, 2004

Dale Bodiya
Manager Water and Wastewater Treatment Section
Maricopa County Environmental Services
1001 N. Central
Phoenix, AZ 85004

VIA FACSIMILE -

RE: Verification of District Funds for Maintenance and Operation of Project Upgrade - Water and Wastewater - Saddle Mountain Unified School District - Tonopah Valley High School

Dear Mr. Bodiya:

On behalf of the Saddle Mountain Unified School District, please accept this letter as acknowledgment of availability of district funds to maintain and operate the water and wastewater treatment plant upgrades.

The District currently operates a water and wastewater treatment plant and has done so for the last twenty plus years. The District currently works with U.S. Filter in proper maintenance and operation of this plant and budgets funds annually for such expenditures.

Please let me know if you require further information.

Respectfully,

Roxanne G. Morris

Roxanne G. Morris - Superintendent of Schools -SMUSD

Appendix D

O & M Cost Estimate

Ruth Fisher School 8/6/2004
WWTP Operation and Maintenance Costs
Power Consumption Phase 2 - 42,000 gpd

Item	Horsepower	Convert to KW	Daily Hours of Opera	Daily KW-hrs			
Headworks/Equalization							
Blower Aeration	10	7.457	24	179			
Pump	3	2.2371	8	18			
Pump	3	2.2371	8	18			
Bar Screen	2	1.4914	8	12			
			Subtotal	227			
Secondary System							
501 Mixer (Anoxic)	1	0.7457	24	18			
501 Blowers	10	30	24	720			
Recycle Pumps	3	2.2371	24	54			
RAS/WAS Pumps	3	2.2371	24	54			
			Subtotal	845			
Tertiary Filtration							
Backwash Pumps	8	5.9656	1	6			
			Subtotal	6			
Solids Handling							
Digester Blower	7.5	5.59275	24	134			
Solids Pump	5	3.7285	2	7			
Polymer Feed Pump	0.25	0.186425	1	0			
			Subtotal	142			
Effluent Pump Station							
Pump	3	2.2371	4	9			
Pump	3	2.2371	4	8.9484			
			Subtotal	18			
					Power Cost	Daily Cost	Annual
Total				1238	0.09 per KWH	$111	$40,659

Parts						
Lubricants						
Tools and Equipment					Total	$2,000
Description	Quantity	Frequency (per year)	Cost/Trip	Total		
Screenings	1 load	24	100	2400		$2,400
Grit (Vactored)						
Digested sludge						
Lab Fees						$10,023
Bags for Sludge						$828
Polymer for Sludge						$198
Chlorine Tablets						$26,537
Dechlorination Tablets						$10,615
TOTAL						$93,260